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### STUDIES OF THE EUPHORBIACEAE, PHYLLANTHOIDEAE II. THE AMERICAN SPECIES OF PHYLLANTHUS DESCRIBED BY LINNAEUS

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DURING THE COURSE of monographic studies of *Phyllanthus* L. and its near allies, it has become necessary to determine the identity of the species described by Linnaeus in order to typify the various genera. This is the more urgent, as the circumscription of a number of genera and subgenera in this subfamily will have to be modified. In this paper I wish to consider only those New World species of *Phyllanthus* described by Linnaeus and to correct, where possible, the misinterpretations they have undergone. The remainder of the Linnaean Phyllanthoideae offer their own special problems which will be dealt with later.

The investigation of the nomenclature of Linnaean *Phyllanthus* has been laborious, and the original draft of this paper could not have been written without the assistance of Drs. Richard A. Scott and Richard S. Cowan, who photographed and examined for me critical specimens at the British Museum of Natural History and at the Linnaean Society. Since then, with the cordial assistance of Mr. William Stearn and Mr. A. H. G. Alston of the British Museum and Mr. O'Grady of the Linnaean Society, I have been able to examine personally the collections in the herbaria of Linnaeus, Miller, Plukenet, and Sloane.

Linnaeus first referred to *Phyllanthus* in the "Systema Naturae" (ed. 1, 1735), where it appears as *Diasperus*, without a description. Otto Kuntze (Rev. Gen. 2: 599-601. 1891), following his extreme principle of strict priority, transferred some four-hundred-odd species of *Phyllanthus* to *Diasperus*, but this was rendered illegal by the decision of later botanical congresses to adopt the "Species Plantarum" as the starting date for genera. In the first edition of the "Genera Plantarum" (1737), Linnaeus adopted the name *Phyllanthus* and thereafter maintained it in the same sense.

In the "Hortus Cliffortianus" (1738) \* appear for the first time three

\* This book is dated "1737" on the title-page, but appears not to have been issued that year. Cf. Smith, Select. Corr. Linnaeus 2: 308 (1821), where Linnaeus in his

American species of *Phyllanthus*. The first species, which in the "Species Plantarum" (1753) appears as *P. epiphyllanthus* L., is the one from which Linnaeus took the generic name. The plant was first listed by Paul Hermann (Parad. Bat. Prodr. 365. 1689) \* as *Phyllanthos americana planta, flores e singulis foliorum crenis proferens*. Linnaeus cited Hermann's work, but did not credit the genus to him in the "Genera Plantarum" (1737), perhaps because the latter did not provide a generic description.

Commelin (Hort. Med. Amstelodam. Rar. Pl. 199-200, *pl.* 102. 1697) provided an excellent illustration which leaves no doubt that the plant in question is the same as the one interpreted today as *P. epiphyllanthus*; the spirally arranged simple lanceolate phylloclades positively distinguish this species among the representatives of sect. *Xylophylla*. Furthermore, the specimen in the "Hortus Cliffortianus" Herbarium represents the same species, although it most likely was collected in the Bahamas, while Commelin's plant came from Puerto Rico.

Unfortunately, Linnaeus subsequent to 1738 obscured the circumscription of *P. epiphyllanthus* by including under it as synonyms several other distinct species of sect. *Xylophylla*. As we shall see, this excessive liberality in ascribing synonyms also led to difficulty with Linnaeus's other species of *Phyllanthus*. In the "Hortus Cliffortianus" only one of the eight synonyms cited, that of Sloane, represents a different element from *P. epiphyllanthus*; but when Linnaeus acquired Patrick Browne's Jamaican collections, he incorrectly incorporated both of Browne's species into his herbarium as *P. epiphyllanthus*. Since neither of these specimens had been seen by Linnaeus during the writing of the "Species Plantarum," the specimen in the "Hortus Cliffortianus" Herbarium must be regarded as the type.

Browne's erroneous description (Civ. Nat. Hist. Jam. 188. 1756) of his *Phyllanthus* 1 was the cause of additional confusion, for he mistook the disk-segments of the female flower for anthers. Linnaeus, thus misled into thinking that the flowers of the Jamaican plant were hermaphrodite, established (Mant. 147. 1771) the new genus *Xylophylla* with its type species *X. latifolia* L. However, the specific name is superfluous and hence illegitimate, because Linnaeus cited *P. epiphyllanthus* as a synonym of it. It is clear from this and from Linnaeus's annotation of both of Browne's specimens that he considered all the American representatives of *Xylophylla* † to belong to a single species.

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letter to Haller of 3 January 1738 states: "Though the *Hortus Cliffortianus* has long been printed, it is not yet published, owing to the tardiness of the engravers." In his letter to Haller of March, 1738 (*op. cit.* 322), Linnaeus observes: "Mr. Cliffort does not intend writing till he can send you his *Hortus*, which I hope he will be able to do in a fortnight, or three weeks at longest."

\* The *Paradisi Batavi Prodomus* follows the *Schola Botanica* (ed. Simon Warton) in the same volume which is paged continuously: *Schola* pp. 1-300, *Paradisi* pp. 301-386.

† Linnaeus included one other species, *Xylophylla longifolia*, based on the Moluccan *Xylophyllus ceramica* of Rumphius (Herb. Amb. 7: 19-20, *pl.* 12. 1755). Although it proved to be a species of *Exocarpos* (Santalaceae), this was the element from which Linnaeus adopted his generic name.



Swartz at first (Prodr. 28. 1788) accepted *Xylophylla* as a distinct genus, and due to Linnaeus's confused interpretation in the "Mantissa" was led to redescribe *P. epiphyllanthus* as a "new" species, *Xylophylla falcata* Sw. Later (Observ. Bot. 113. 1791) he recognized the confusion, and realigned the species with comparative success. He restricted the references of Commelin and Catesby to *X. falcata*, and those of Plukenet (Phytogr. pl. 247, fig. 4. 1692; Almagest. Bot. 154. 1696), Sloane (Nat. Hist. Jam. 80. 1707), and Browne to *Xylophylla latifolia*. Although he incorrectly referred some references to *X. angustifolia* Sw., this fortunately made no difference as far as later nomenclature is concerned. Swartz's revision, by removing all the extraneous elements, effectively typified *Xylophylla latifolia*. When he later (Flor. Ind. Occ. 1109. 1800) reduced *Xylophylla* to a synonym of *Phyllanthus* and transferred the species in question, the epithet *latifolia* was at last legitimized (according to present rules) in the combination *Phyllanthus latifolius* Sw.

As Fawcett and Rendle (Jour. Bot. 57: 67. 1919) have pointed out, the typical element of *P. latifolius* Sw. must be the *Phyllanthus* 1 of Browne; the holotype is therefore the Browne specimen in the Linnaean Herbarium. This species is characterized by female flowers with the disk divided into discrete segments, which were mistaken by both Browne and Swartz for stamens. However, in Mueller's revision of the Euphorbiaceae (DC. Prodr. 15[2]: 431. 1866), *P. latifolius* is described as having a cupuliform disk as high as the ovary; but Mueller's description was based on a specimen of Swartz in the Stockholm herbarium, not on Browne's collection. At this writing I have before me Swartz's specimens from the Riksmuseum, Stockholm; there are three sheets labelled *Phyllanthus* (or *Xylophylla*) *latifolia*, but only one label is written in Swartz's hand. The other two specimens are in the hand of Wikstroem, and it is these which represent the different species interpreted by Mueller as *P. latifolius*. It seems evident that Mueller was misled by some confusion in labelling in the Swartzian herbarium, and that Fawcett and Rendle were correct in considering Mueller's plant as an undescribed species, which they named *P. swartzii* Fawc. & Rend. Unfortunately, they overlooked the previously published *P. swartzii* Kostel. (Allgem. Med. Pharm. Fl. 1771. 1836), based on an entirely different species in sect. *Phyllanthus* which was also collected in Jamaica by Swartz.

The plant confused by Mueller and renamed by Fawcett and Rendle represents a population confined to the hills of western Jamaica, between Dolphin Head and the Cockpit Country, but perhaps extending to near the coast.\* Its incrassate floral receptacles, urceolate female disk, and stylar column as high as the ovary make it a morphologically very distinct entity. In many respects, indeed, it approaches *P. coxianus* Fawc. & Rend., from St. Ann and Trelawney parishes, which has brilliant red flowers of similar aspect and is vegetatively very similar as well. But on the basis

\* In addition to the two sheets in the Riksmuseum there is also a specimen in Herb. Mus. Brit. labelled "Jamaica. Seacoast. Dr. Swartz." Evidently Swartz confounded this plant with true *P. latifolius* on the basis of its close vegetative resemblance.

of our present knowledge, the morphological discontinuity being so profound, the population in question seems best designated in the rank of species. Because of the preoccupation of name mentioned above, it is here designated as *Phyllanthus dingleri* (nom. nov.: *P. swartzii* Fawc. & Rend. Jour. Bot. 57: 67. 1919; non *P. swarzii* Kostel., 1836), in honor of Hermann Dingler (1846–1937), whose exhaustive researches on the morphology of sect. *Xylophylla* are eminently deserving of recognition.

With this perhaps over-lengthy discussion we have covered the history of *P. epiphyllanthus* L. and its literary offspring. One more point must still be mentioned. As noted above, the name *Phyllanthus* was first applied in 1689 by Hermann (as *Phyllanthos*) to *P. epiphyllanthus*, doubtless because the floriferous phylloclades appeared to be leaves with flowers in marginal notches. It might be supposed, therefore, that *P. epiphyllanthus* would be the type of the genus. This is a matter of some importance, because the phylloclade-bearing species have even in recent times occasionally been considered as constituting a distinct genus *Xylophylla* (e.g., L. H. Bailey, New Man. Cult. Plants). *Xylophylla latifolia* L. has already been shown to be based on the same type as *P. epiphyllanthus* L., so that if the latter species is considered the type of *Phyllanthus*, *Xylophylla* must be rejected as a superfluous and illegitimate name.

Hitchcock and Greene, in their compilation of "Species Lectotypicae Generum Linnaei" (Brittonia 6: 114. 1947) selected *Phyllanthus niruri* L. as the type of the genus. While their decision was likely purely arbitrary, it is supported by a critical study of Linnaean literature. In the first edition of the "Genera Plantarum" (1737, p. 282) Linnaeus noted that the floral characters were provided by *Niruri* (= *P. niruri* L.), although the name of the genus was taken from *P. epiphyllanthus*. Since for Linnaeus, floral characters always took precedence over vegetative ones in the definition of genera, it would seem only logical to fix on *P. niruri* as the type. His removal of *P. epiphyllanthus* to a separate genus *Xylophylla* even more obviously points to the same conclusion.

The matter, however, is not settled with the choice of *P. niruri* L. as the generic type. This species, as it happens, has been consistently misinterpreted by subsequent authors, the "*Phyllanthus niruri*" of recent floras and manuals almost invariably being one or more species different from the plant described by Linnaeus. The confusion is perhaps best documented in the treatment given the name by Mueller Argoviensis (DC. Prodr. 15[2]: 406. 1866). Here *P. niruri* is interpreted as composed of six varieties; actually, these entities represent five distinct species, no one of which is the *P. niruri* of Linnaeus!

Mueller (loc. cit.) noted under *P. niruri*  $\beta$  *genuinus* that he had seen an authentic specimen in the Linnaean Herbarium, but the specimen annotated "Niruri" in the Linnaean Herbarium (sheet 1105–2) obviously represents a different species from *P. niruri* sensu Mueller. The narrow, almost acicular, stipules of the plant are quite unlike the broader lanceolate ones of the plant mistaken for *P. niruri* by Mueller. The specimens in the Hortus Cliffortianus and Hortus Upsaliensis Herbaria are obviously con-



specific and even have the appearance of duplicates that were collected at the same time. When this is taken into account together with Linnaeus's description of the position of the sexes (Hort. Upsal. 282. 1748), there can be little doubt as to the plant described by Linnaeus as *Phyllanthus niruri*; it is the West Indian form of the widespread New World species currently passing as *P. lathyroides* H.B.K.

Research into the original citations given by Linnaeus in the "Hortus Cliffortianus" has made it possible to unravel some of the mystery surrounding the species. The specific epithet *niruri* was based, as was Linnaeus's wont, on a generic name: *Niruri*. First published by Rheede tot Draakestein (Hort. Malabar. 2: 45, fig. 27. 1679 [misquoted by Linnaeus as vol. 10, fig. 27]), it was adopted by Martyn (Hist. Pl. Rar. pl. 8. 1728) as the generic name for a West Indian species. Martyn's plant, splendidly illustrated in the first color-printed botanical book, bore the name *Niruri barbadense* . . . *petiolis florum brevissimis*. This name actually was originated by Isaac Rand in a list of plants presented to the Royal Society from the Chelsea Gardens by the Company of Apothecaries (Trans. Roy. Acad. 35: 293-296. 1727). Linnaeus's use of the epithet *niruri* and his assignment of the species to Barbados (with only a questionable reference to Malabar) plainly indicates that in the "Hortus Cliffortianus" he was describing the plant of Martyn and of Rand. In the preface of that work he acknowledges the receipt of tropical American plants from Philip Miller, and he may have obtained *P. niruri* in 1736 when he visited Miller at the Chelsea Gardens.\*

The confusion which has attended the name *P. niruri* to the present day is due in large part to Linnaeus's inclusion under it of synonyms which actually belong to different species. His remark following the listing of the species in the "Hortus Cliffortianus" explains his attitude: "Variat foliorum figura & magnitudine, hinc plure tenentur species quam re ipsa sunt." Linnaeus would in this instance have done well to heed the advice of Haller (letter of 17 Oct. 1748, transl. Smith, Select. Corr. Linnaeus 2: 431. 1821): "Do not strike out species, and reduce them to varieties, so frequently as you are accustomed . . . I cannot, without concern, see good and genuine plants perish, as it were, and become lost to botanists, under the title of varieties."

Haller's warning was prophetic as far as concerns *P. niruri*, for the overly broad concept adopted by Linnaeus has led subsequent botanists to place at least a dozen different herbaceous species of *Phyllanthus* under this one name. Linnaeus's indication of range in the "Species Plantarum" of 1753 as merely "in Indiis" certainly encouraged these later misidentifications. In fairness to Linnaeus, however, it should be made clear that not

\* Rand's comment on the plate of *P. niruri* in his review of Martyn's "Historia Plantarum Rariorum" (Trans. Roy. Acad. 36: 5. 1729) would indicate that Martyn's plant was the one from the Chelsea Gardens. Furthermore, Rand's specimen and a duplicate sheet with the notation "Herbar Miller" are preserved in Herb. Mus. Brit. Evidently, therefore, Martyn, Rand, Miller, and Linnaeus all were dealing with duplicates or descendants of the same stock in the Chelsea Gardens.

only are some of the relatives of *P. niruri* "cryptic" species which are superficially very similar, but also some of these weedy species appear to have very early been carried from one hemisphere to the other. Consequently, references in the "Species Plantarum" to illustrations of Plukenet, Rheede, et al., may be meaningless unless the specimens from which the illustrations were taken happen to be still in existence. For example, Linnaeus singled out the drawing by Plukenet (Phytogr. *pl.* 183, *fig.* 5) as "good" for *P. niruri*; but an examination of Plukenet's specimens\* shows that the plant is poorly depicted in the drawing and certainly is not the species which Linnaeus had before him when writing the account in the "Hortus Cliffortianus."

The treatment of *P. niruri* by Mueller must now be gone into more thoroughly, since his work has been followed by the majority of later workers. I have already pointed out that the plant designated by Mueller as *P. niruri*  $\beta$  *genuinus* is not the same species as *P. niruri* L.; the latter differs from Mueller's plant by its much narrower and longer stipules, unisexual cymules, and verruculose rather than striate seeds. Yet Mueller claimed (DC. Prodr. 15[2]: 406. 1866) to have seen an authentic specimen in the Linnaean Herbarium. The sheet which is obviously true *P. niruri* (1105-2) was annotated as such by Linnaeus; but there is one specimen among the Linnaean collection which represents *P. niruri* *sensu* Mueller. It is on the right-hand side of sheet 1105-5; but the left-hand specimen is *P. urinaria* L. and the sheet is pinned to sheet 1105-4, which is also *P. urinaria*, and annotated as such by Linnaeus. It seems probable, therefore, that the plant which Mueller equated with *P. niruri* was considered by Linnaeus to be only a form of *P. urinaria*. It is consequently difficult to understand why Mueller ignored sheet 1105-2, plainly marked as *Niruri*.

The result of Mueller's misinterpretation has been a curious duplex adaptation of the name *P. niruri*. The plant originally introduced into the Chelsea Gardens and given to Linnaeus by Miller appears to have been distributed to several different botanical gardens under the correct name. Thus when Pax illustrated *P. niruri* from a living plant in the first edition of the "Natürlichen Pflanzenfamilien" (3[5]: *fig.* 14. 1890), the plant was correctly identified; but the vast majority of the dried specimens in the Berlin herbarium under that name were doubtless misidentified, as they were everywhere else. Most of these mislabelled specimens represent a single weedy species, which has become circumtropical, in contrast to the strictly American *P. niruri*.

We now have to determine the correct name of this usurper which Mueller designated as *P. niruri*  $\beta$  *genuinus*. The first post-Linnaean author

\* There are in Plukenet's Herbarium, which is incorporated in Herb. Sloane at Herb. Mus. Brit., two collections associated with plate 183, *fig.* 5 of the "Phytographia." The first, vol. 92 p. 173, which bears the legend "ex Coromandel," is of special interest in indicating that this West Indian species, *P. amarus* Schum. & Thon., had reached India before 1690. The second, vol. 96 p. 46, is also *P. amarus*; Plukenet appears not to have had true *P. niruri* L.



to deal critically with the identity of *P. niruri* was F. K. Medicus, who in his monograph of the Malvaceous Alliance (1787) published the name *Urinaria erecta*, apparently based on John Burman's *Urinaria indica, erecta, vulgaris* (Thes. Zeyl. 230. 1737). The identity of Burman's plant is uncertain,\* but in any event *Urinaria erecta* Medic. is not Mueller's plant, as is evident from Medicus's earlier description (Bot. Beobacht. 263. 1783) of the inflorescence and flowers. In fact, in the earlier reference Medicus called his plant *P. niruri*, and — judging from his description — correctly so. Since Medicus proposed *Urinaria erecta* as a deliberate substitution for *P. niruri* L. (he said he was "restoring the older name,") his name is not only synonymous but also superfluous and hence illegitimate.

Recently, when dealing with the herbaceous species of sect. *Phyllanthus* for the West Indies (Contr. Gray Herb. 176: 53. 1955), I thought that the two species confused under the epithet *niruri* had been first distinguished by Kosteletzsky (Allg. Med. Pharm. Fl. 1771. 1836). Following his description of *P. niruri*, to which are correctly ascribed male flowers "unten und gepaart" and female "oben und einzeln," he added:

"In Jamaika findet sich eine sehr ähnliche Art: *Ph. Swartzii*. (Ph. Niruri. Sw.) welche jedoch nur einzelne Blüthen in den Blattachseln (die ♂ und ♀ gemengt unter einander) und 5-theilige Kelche besitzt."

The new species was presumably based on Swartz's description of "*Phyllanthus niruri*" in his "Observationes Botanicae," pp. 354–355 (1791); there is no way of being sure if Kosteletzsky saw a specimen of Swartz. In Swartz's herbarium in the Riksmuseum, Stockholm, there are a number of sheets annotated by him or by some of his colleagues as *P. niruri*. No less than three species are represented, but only one of these has the flowers arranged in the manner which fits the descriptions of Swartz and Kosteletzsky. This species is the one designated by Mueller as *P. niruri*  $\beta$  *genuinus*, and I therefore (loc. cit.) adopted *P. swartzii* Kostel. as the correct name for the plant.

However, since then and while studying the collections in Herb. Kew, I have discovered that Kosteletzsky's proposed species had been anticipated by the *P. amarus* of Schumacher and Thonning (Beskr. Pl. Guin. 2: 195–196. 1829), based on a type from West Africa which I had not examined. I had partially been misled by the fact that Mueller (DC. Prodr. 15[2]: 407. 1866) associated *P. amarus* with *P. debilis* Willd., a very different species. However, drawings and observations of the type specimen (in Herb. Copenhagen) made by Brennan and deposited in Herb. Kew, together with his excellent published discussion (Kew Bull. 1950: 215–218. 1950),

\* Burman's second species, *Urinaria zeylanica repens cauliculis rubentibus* (op. cit. 231) is represented in Herb. Hermann (BM) by three specimens on the following sheets: vol. 2, p. 7; vol. 3, p. 55; vol. 4, p. 41. These, and illustrations nos. 11 and 429 of Hermann's "Icones" (also in Herb. Mus. Brit.), certainly represent *P. urinaria* L. But there appear to be no specimens of *Urinaria indica, erecta, vulgaris*; and of the two *Icones* supposed to refer to this species, no. 53 appears to be a *Breynia*, while no. 56 suggests the widespread weedy species of sect. *Menarda*, *P. tenellus* Roxb. The illustration in the "Thesaurus" represents a different herbaceous species which could be *P. amarus* but whose exact identity must remain in doubt.

leave no doubt as to the identity of the species in question. Brenan's description of the unisexual cymules — which Schumacher and Thonning, like Kosteletzsky, recognized as a chief distinguishing character of the species — clearly indicates that *P. niruri*  $\beta$  *genuinus* Muell. Arg. and *P. swartzii* Kostel. are synonyms of *P. amarus* Schum. & Thon. It is to this last species that many, perhaps most, of the Old-World records of "*Phyllanthus niruri*" must be referred.

As previously mentioned, the true *P. niruri* L. is native of and restricted to the New World. There is every reason to believe that *P. amarus* is also natively an American species, although it (as "*Phyllanthus niruri*") has in many floras been indicated as native to the Old World. The closest relative of *P. amarus*, however, is certainly *P. abnormis* Baill., a plant confined to sandy areas in Texas and Florida which has the same flower-arrangement and differs only in its perennial habit and larger fruit. It is therefore most likely that *P. amarus* originated in the Caribbean area as a vicarious species of *P. abnormis* of the southern U. S., but was in early colonial days spread around the tropics by trading vessels.

On the other hand, as is the case with several other American species, *P. amarus* shows a rather close relationship to one Old World species.\* This plant, which was designated by Mueller (Linnaea 32: 43. 1863) as *P. niruri*  $\beta$  *scabrellus*, is superficially so like *P. amarus* that the two have almost invariably been confused. In my recent consideration of the West Indian species (Contr. Gray Herb. 176: 53. 1955), I applied the new specific name *P. fraternus* to this plant, which appears to be originally native to Pakistan and India but which has appeared in a few widely-scattered localities in the West Indies. However, while making a routine survey of the collections in Herb. Kew, I discovered that Hutchinson had already in 1920 independently described this species from a South African collection as *P. asperulatus* Hutch.; this well demonstrates how difficult it is, despite the greatest precautions, to establish and define specific names in this complex of widely and capriciously distributed weeds.

In order to finish this detective story of what happened to *P. niruri*, we now have to return to *P. niruri* sensu Swartz (Obs. Bot.). Swartz's description has been shown to have served as the basis for *P. swartzii* Kostel., but this disposes of only one of the three elements included therein. The erratic C. S. Rafinesque now enters upon the stage, for he also based a new species on *P. niruri* sensu Sw. in his "revision" of *Phyllanthus* (Sylva Tellur. 91-92. 1838). In Rafinesque's own words, his attempt "must be deemed very imperfect"; one can surmise from such uncharacteristic modesty that this is an understatement. The "revision," in fact, reveals a shocking lack of taste and judgment even for Rafinesque, and one can understand why it was ignored *in toto* by Mueller.

Nevertheless, there is one passable specific description in the article,

\* As examples may be adduced the evident close relationships of *P. niruri* and *P. stipulatus* with *P. benguelensis* and *P. microphyllinus*, respectively, both the latter from west Africa.



under the genus *Moeroris* (taken from Rumphius's name for some herbaceous species of *Phyllanthus*):

"MOERORIS Raf. diff. cal. 5phyl. glandulis 5 ad basis, caps. 3loc. 6valv. . . *Moeroris stipulata* Raf. Phyll. niruri, Swartz. Herbacea, foliolis obl. glaucis subsess. stipulis 2 geminatis coloratis, fl. axil. ped. nutantib. — Mts. of Jamaica."

As with Kosteletzsky's description, so this too appears to be taken from the treatment in the "Observationes Botanicae." But the details specified by Rafinesque — "stipulatis 2 geminatis coloratis" and "Mts. of Jamaica" — effectively eliminate two of the three elements in the Swartzian concept. Kosteletzsky's plant, (*P. amarus*) is rather unusual among the West Indian herbaceous species in having stipules which are *not* at all reddish-tinged; and the third element, which according to Swartz (loc. cit.) was collected on Hispaniola, proves to be *P. fuertesii* Urb., a species which does not occur in Jamaica. This leaves as representing Rafinesque's name the plant with reddish stipules and the flower arrangement (though not the seeds) of *P. niruri* L. It is the widespread species of swampy habitats in tropical America which at present goes under the name of *P. diffusus* Kl. This species must now be known as *P. stipulatus* (Raf.) Webster (Contr. Gray Herb. 176: 53. 1955).

No doubt it may appear unusual and even undesirable that two different species should both be based on *P. niruri* sensu Sw., but the application of modern principles of typification leads irresistibly to this conclusion. In a sense, the species of both Kosteletzsky and Rafinesque may be said to have been established by "blind luck," for it is quite possible that both authors merely pilfered from Swartz's description without seeing any specimens. But in evaluating their proposed names we must give these authors the benefit of the doubt, particularly since their names can be associated with definite specimens.

The history of the first two species described in the "Hortus Cliffortianus" having been followed out to what may appear painful lengths, we have to consider the third species, *P. grandifolius* L., which has been as badly misinterpreted as *P. niruri*. Linnaeus's original description (Hort. Cliffort. 439) is brief:

3. PHYLLANTHUS caule arboreo, foliis ovatis obtusis integerrimis.

Niruri arborescens, foliis singularibus subrotundis & subtus incanis, fructo maximo. *Houst. mss. Crescit in America, communicata per Millerum. Folia magnitudine palmi, subtus glauca.*

Even from this short description, it is easy to guess what species is indicated, and this is confirmed by examination of the specimen in the Hortus Cliffortianus Herbarium. It consists of a sterile branch mounted with Houston's manuscript label, and is obviously the species which was described in 1817 from a Campeche collection as *P. glaucescens* H.B.K.

Some generally overlooked additional information about *P. grandifolius* is furnished by Philip Miller (Gard. Dict. ed. 8. 1768), who redescribed the same plant,\* apparently having overlooked Linnaeus's account:

\* There is in Herb. Mus. Brit. a sheet of *P. grandifolius* with the MS label: "Niruri

3. *ANDRACHNE* (*Arborea*) foliis ovatis obtusis, subtus incanis, caule arboreo. . . discovered by the late Dr. William Houston, growing naturally at Campeachy. . .

This clears up the mystery of *Andrachne arborea* Mill., a name which Mueller overlooked and which Pax and Hoffmann (Pflanzenr. IV. 147. XV.: 178. 1922) were unable to place, remarking it as "vix recognoscenda et omnino dubia."

Mueller Argoviensis unfortunately brought the application of *P. grandifolius* into serious confusion by applying the name to an entirely different plant from the West Indies, which does not occur in Mexico or Central America. This West Indian plant had been described by Willdenow (Enum. Pl. Hort. Berol. Suppl. 64. 1813) as *P. juglandifolius*. Willdenow gave as a synonym "*Phyllanthus grandifolius Hortul.*," indicating that the plant had acquired this name while in cultivation. Herbarium sheets of the species collected from various European botanic gardens in the early nineteenth century often bear this name, which was simply a misidentification.

Since Willdenow's name was accepted for the West Indian plant by Grisebach (Pl. Wright. 1: 158. 1860) and Baillon (Adansonia 1: 38-39. 1860-61) not long before Mueller's revision, it is difficult to see what led to the latter's erroneous application. Even if Mueller did not look at the original description in the "Hortus Cliffortianus," an attentive reading of the passage in the "Species Plantarum" should have sufficed to show that Linnaeus was not dealing with the West Indian plant. The phrase "foliis ovatis obtusis integerrimis" clearly sets the plant off from the other five species included in *Phyllanthus*, all of which (except possibly *P. maderaspatensis*) Linnaeus considered to have either pinnate or crenate leaves. As is suggested by Willdenow's choice of the epithet *juglandifolius*, the West Indian plant would certainly have been considered pinnate-leaved by Linnaeus.

There can be no doubt, therefore, that *P. juglandifolius* Willd. is the name which must be applied to the West Indian species called *P. grandifolius*  $\gamma$  *genuinus* by Mueller. The plant interpreted by Mueller as *P. glaucescens* H.B.K. must be called *P. grandifolius* L. Although a number of species closely related to *P. glaucescens* have been described, it is highly probable that that species is a positive synonym of *P. grandifolius* L., for both were collected from the same region, and the type specimen in the Hortus Cliffortianus Herbarium closely resembles typical material of *P. glaucescens*.

The impression which remains from this excursion into the Augean stables of nomenclature is that the typification of Linnaean species was not considered very seriously by Mueller, or most of the authors succeeding him. The interpretations adopted here are those which fix the Linnaean

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fructo maximo Houst. ms. 159. Campeachy, Houston." This sheet, presumably from Herb Miller, is evidently a duplicate of that in the Hortus Cliffortianus Herbarium, so that Miller's and Linnaeus's species are exact synonyms.



names to the plants actually familiar to Linnaeus himself. It must be admitted, of course, that this is possible chiefly because authentic specimens are available in the various Linnaean herbaria; it would have been impossible, in the instance of *P. niruri*, ever to have untangled the confusion on the basis of the illustrations cited by Linnaeus and later authors.

Svenson (Rhodora 47: 388. 1945) has pointed out that the Linnaean species is an aggregate—often of several different species by modern standards—based on descriptions, plates, dried specimens, and living plants. He concludes that since “all synonyms seem to have been of equal value . . . selection of a representative element for each species would seem largely dependent on usage.” The involved discussions in the present paper certainly illustrate how much caution should be exercised in selecting “representative elements,” but I cannot agree that “usage” is the touchstone to solve the problem. In fact, the dangers attendant on typifying species through “usage” are very great; it was exactly by such an adoption of usage that Mueller made such serious errors in interpreting two of Linnaeus’s three American species of *Phyllanthus*. When, as in the nomenclatural history of *P. niruri*, usage is so ill-informed and remote from biological reality, it is futile to expect that it can provide any stability. The only positive course to follow in interpreting Linnaean species is to determine which of the elements of the species were personally familiar to that author and, wherever possible, to designate a particular specimen as holotype. Even though this may not always be possible, taxonomists should attempt to reduce the chaos as much as possible.

#### SUMMARY

Linnaeus in the “Hortus Cliffortianus” described three American species of *Phyllanthus* which in the “Species Plantarum” became *P. epiphyllanthus*, *P. niruri*, and *P. grandifolius*. Material of the latter two species was probably given to Linnaeus by Philip Miller, of the Chelsea Gardens; and Linnaeus was familiar with *P. niruri*, at least, from living specimens. Linnaeus took the generic name from Hermann’s original citation of *P. epiphyllanthus*, but based the generic character on the flower of *P. niruri*. The latter species is therefore the generic type.

Linnaeus confused the application of *P. epiphyllanthus* by erroneously including with it some distinct species collected in Jamaica by Patrick Browne, and redescribed the entire ensemble as a new genus and species *Xylophylla latifolia*, because of a misinterpretation of Browne’s floral description. Olaf Swartz, though still misinterpreting the flower structure, nevertheless reduced *Xylophylla* to the synonymy of *Phyllanthus* and redefined *P. epiphyllanthus* and *P. latifolius*. The latter species was misconstrued by Mueller Argoviensis, who confounded it with an undescribed species of Swartz finally established as *P. swartzii* Fawc. & Rend.; the latter name being preoccupied, *P. dingleri* Webster is proposed in its stead.

Linnaeus’s *P. niruri*, though well defined in the “Hortus Cliffortianus,” became confused owing to his erroneous conclusion of other species as

synonyms, and to later misidentifications by subsequent authors. The commonest weedy species so mistaken for *P. niruri*, by Mueller and others, was defined as *P. swartzii* by Kosteletsky in 1836, based on the *P. niruri* of Swartz; but the earliest name for it appears to be *P. amarus* Schum. & Thon., as established by Brenan. Another weedy species also often confounded with *P. niruri*, was — by a curious coincidence — also based on Swartz's *P. niruri* by Rafinesque. Rafinesque's epithet having priority over the generally accepted *P. diffusus* Kl., the species in question must be known as *P. stipulatus* (Raf.) Webster.

Linnaeus's *P. grandifolius*, based on a collection of William Houston from Campeche, became confused owing to the name being misapplied to a very different West Indian species. The latter, *P. juglandifolius* Willd., was correctly interpreted until the monograph of Mueller Argoviensis, who adopted the prevalent horticultural misidentification and called Willdenow's plant *P. grandifolius*. The latter name must now be adopted for the plant currently passing as *P. glaucescens* H.B.K., and Willdenow's name readopted.

It is concluded that Svenson's appeal to "usage" as the determining factor in typifying Linnaean species is futile, and that the only practicable course is to fix the names on actual specimens, if at all possible.

#### NOMENCLATURAL RESUME \*

##### *Phyllanthus epiphyllanthus* L. Sp. Pl. 981. 1753.

*Phyllanthos americana planta, flores e singulis foliorum crenis proferens* Herm. Par. Bat. Prodr. 365. 1689; Commelin, Hort. Med. Amst. Rar. Pl. 199–200, fig. 102. 1697; Catesb. Nat. Hist. Carol. 26, pl. 26. 1725 [Catesby (BM)].

*Phyllanthos Americana angustiora & longiori ramosa &c.* Pluk. Phytogr. 3: pl. 247, fig. 4. 1692 [Herb. Sloane 97: 100; 101: 106 (BM)].

*Phyllanthus foliis lanceolatis serratis: crenis floriferis* L. Hort. Cliffort. 439. 1738 (excl. ref. Sloane & Plukenet) [Herb. Hort. Cliffort. (BM)].

*Xylophylla latifolia* L. Mant. Alt. 221. 1771 (ex. p., excl. ref. Browne); non *X. latifolia* Sw.

*Xylophylla falcata* Sw. Prodr. 28. 1788 [Swartz (S, HOLOTYPE)].

*Phyllanthus falcatus* Sw. Fl. Ind. Occ. 2: 1115. 1800.

*Xylophylla epiphyllanthus* (L.) Britton in Small, Fl. Florida Keys 76. 1913.

*Exocarpus epiphyllanthus* (L.) Merr. Interpr. Rumph. Herb. Amb. 208. 1917.

##### *Phyllanthus latifolius* Sw. Fl. Ind. Occ. 2: 1109. 1800.

*Hemionitidi affinis Americana epiphyllanthos &c.* Pluk. Phytogr. 1: pl. 36, fig. 7. 1691 [Herb. Sloane 90: 51 (BM)].

\* The references in brackets indicate the herbarium material examined by me on which the descriptions, and often the illustrations, are based. The numbers of Herb. Sloane refer to the volume and page numbers of this large herbarium, which is bound in folios and kept in separate cabinets in Herb. Mus. Brit. The abbreviations otherwise are the standard ones of Lanjouw and Stafleu. The synonymy does not purport to be complete; only the older names or those specially relevant are cited.



*Lonchitidi affinis arbor anomala folio &c.* Sloane, Cat. Pl. Jam. 16. 1696; Nat. Hist. Jam. 1: 80. 1707 [Herb. Sloane 1: 62 (BM)].

*Phyllanthus* 1. *Foliis latioribus utrinque acuminatis &c.* Browne, Civ. Nat. Hist. Jam. 188. 1756 [Herb. Linn. 1105-1 (LINN)].

*Xylophylla latifolia* L. Mant. Alt. 221. 1771 (as to the plant of Browne only); Sw. Prodr. 28. 1788; Obs. Bot. 113. 1791.

*Phyllanthus isolepis* Urb. Symb. Ant. 3: 290. 1902 [Ferry Pen, Jamaica, Campbell 6280 (NY, fragment of type)].

*Phyllanthus dingleri* Webster, nom. nov. [Jamaica, Swartz (S, HOLOTYPE; BM, ISOTYPE)].

*Phyllanthus latifolius* sensu Muell. Arg. in DC. Prodr. 15(2): 431. 1866; non Linnaeus nec Sw.

*Phyllanthus swartzii* Fawc. & Rend. Jour. Bot. 57: 67. 1919; non *P. swartzii* Kostel., 1836.

*Phyllanthus niruri* L. Sp. Pl. 981. 1753 [Herb. Linn. 1105-2 (LINN)].

*Niruri barbadense*. . . *petiolis florum brevissimis* Rand, Trans. Roy. Soc. 35: 295. 1727 [ex Chelsea Garden (BM)]; Martyn, Hist. Pl. Rar. pl. 8. 1728.

*Phyllanthus foliis alternis alternatim pinnatis &c.* L. Hort. Cliffort. 439. 1738 (excl. ref. Burm. & Rheede) [Herb. Hort. Cliffort. (BM, HOLOTYPE of *P. niruri*)].

*Phyllanthus lathyroides* H.B.K. Nov. Gen. & Sp. 2: 110. 1817 [Herb. Humboldt (P, type collection)].

*Phyllanthus purpurascens* H.B.K. ibid. [Herb. Humboldt (P, type collection)].

*Phyllanthus chlorophaeus* Baill. Adansonia 1: 27. 1860-61. [Mexico, Jurgensen 858 (G, HOLOTYPE)].

*Phyllanthus amarus* Schum. & Th. Kongl. Danske Vidensk. Selsk. Skr. 4: 195-196. 1829 \* [type fragment ex Herb. Copenhagen & drawings of floral details by Brenan (K)].

*Fructiculus capsularis, hexapetalis &c.* Pluk. Phytogr. 3: pl. 183, fig. 5. 1692 [Herb. Sloane 92: 173; 96: 46 (BM)].

*Phyllanthus niruri* sensu Sw. Obs. Bot. 354-355. 1791 (ex p.).

*Phyllanthus swartzii* Kostel. Allgem. Med. Pharm. Fl. 1771. 1836 [Jamaica, Swartz (S, HOLOTYPE)].

*Phyllanthus niruri*  $\beta$  *genuinus* Muell. Arg. in DC. Prodr. 15(2): 406. 1866; et auct. seq., non *P. niruri* L.

*Phyllanthus nanus* Hook. f. Fl. Br. Ind. 5: 298. 1887 [Burma, Griffith (K, HOLOTYPE)].

*Phyllanthus stipulatus* (Raf.) Webster, Contr. Gray Herb. 176: 53. 1955.

*Phyllanthus niruri* sensu Sw. Obs. Bot. 354-355. 1791 (ex p.).

*Moeroris stipulata* Raf. Sylva Tellur. 91-92. 1838 [Jamaica, Swartz (S, HOLOTYPE)].

\* This is often cited as "Beskr. Guin. Pl.", a separately issued reprint usually considered as dating from 1827, but fide Fl. Males. (4: ccii. 1954) appearing in 1829.

*Phyllanthus difusus* Klotzsch, Bot. Voy. Herald 105. 1853 [Panama, *Seemann* 198 (K, HOLOTYPE)].

*Phyllanthus asperulatus* Hutch. Kew Bull. 1920: 27–28. 1920 [Transvaal, *Schlechter* 11866 (K, HOLOTYPE)].

*Phyllanthus niruri*  $\beta$  *scabrellus* Muell. Arg. Linnaea 32: 43. 1863; not *P. scabrellus* Webb, as to type.

*Phyllanthus fraternus* Webster, Contr. Gray Herb. 176: 53. 1955 [Punjab, *Thomas Thomson* (K, HOLOTYPE)].

*Phyllanthus grandifolius* L. Sp. Pl. 981. 1753 (as *P. grandifolia*).

*Phyllanthus caule arboreo, foliis ovatis obtusis integerrimis* L. Hort. Clifort. 439. 1738 [Herb. Hort. Clifort. (BM)].

*Andrachne arborea* Miller, Gard. Dict. ed. 8. 1768 ["Campeachy," *Houston* (ex herb. Miller, BM)].

*Phyllanthus glaucescens* H.B.K. Nov. Gen. & Sp. 2: 115. 1817 [Campeche, Herb. Humboldt (P, type collection)].

*Phyllanthus juglandifolius* Willd. Enum. Pl. Hort. Berol. Suppl. 64–65. 1813 [Herb. Willdenow (B, HOLOTYPE)].

*Phyllanthus grandifolius* sensu Poir. Encycl. Method. 5: 296. 1804; et auct. seq., non L.

*Agyneia berterii* Spr. Syst. Veg. 3: 19. 1826 [Puerto Rico, *Bertero* (P)].

*Phyllanthus quinquefidus* Sessé & Moc. Fl. Mex. 212. 1894 [*Sessé et al.*, Pl. Nov. Hisp. (F, type collection)].

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## A MONOGRAPH OF THE GENUS PHILADELPHUS \*

SHIU-YING HU

*With plates V and VI*Section 5. *Microphyllus* (Koehne), stat. nov.*Philadelphus* subg. II. *Euphiladelphus* sect. 5. *Microphyllus* (Koehne), stat. nov.*Philadelphus* Reihe 4. *Decorticatae pauciflorae* Koehne, Deutsche Dendr. 180, 184. 1893, pro parte.*Philadelphus* sect. *Poecilostigma* subsect. *Microphylli* Koehne in Gartenfl. 45: 450, 506. 1896; et in Deutsch. Dendr. Ges. 1904(13): 78. 1904.*Philadelphus Microphylli* Rydb. in N. Am. Fl. 22: 163. 1905, in clavi, s. stat.*Philadelphus* ser. *Microphylli* (Koehne) Rehder, Cult. Trees Shrubs ed. 2, 273. 1940; et Bibl. Cult. Trees Shrubs 194. 1949.TYPE SPECIES: *P. microphyllus* Gray.

Compact low shrubs less than 2 m. high, the bark exfoliate, rarely closed; leaves small, ovate, rarely elliptic or lanceolate, usually less than 2 cm. long, entire and ciliate, generally densely pubescent beneath; flowers solitary, rarely ternate; hypanthium pubescent, usually incanous or lanate; petals white, sometimes purple at the base; stamens 35–50, rarely less than 25; disc and style generally glabrous; capsules subglobose, rarely ellipsoid or turbinate; seeds usually very short caudate.

Species in this section are xerophytic. In order to adapt themselves to an arid condition of living, in the course of evolution different species have acquired different types of indumentum on their small leaves and flowers. These hairs can be employed as a convenient means for the identification of species.

Species of this section are concentrated in the semidesert area of the southern Rocky Mountains, extending southward to northern Mexico. As shown in Map 6, most of the species are isolated endemics. *Philadelphus occidentalis* and *P. microphyllus* are two relatively widespread species. Their ranges overlap in central and western Colorado, eastern Utah, Clark County in Nevada, and Brewster County in Texas. Nevertheless there is a difference in the general area of their concentration. *Philadelphus occidentalis* occurs in the north and west, while *P. microphyllus* is confined to the southeast. The area of *P. argenteus* is rather wide, but its degree of concentration is low. The distribution of the species of this section is shown in map 7.

\* Continued from volume XXXVI, page 368.



MAP 7. The distribution of the species of *Philadelphus* in the section *Microphyllus*.

KEY TO THE SPECIES

- A. Hypanthium and sepals glabrous or only sparsely pilose at the base. .... 50. *P. microphyllus*.
- AA. Hypanthium and sepals uniformly pubescent.
  - B. Leaves glabrescent or sparsely villose above; hypanthium lanate.
    - C. Corolla cruciform; base of the style glabrous; seeds long-caudate; upper surface of the leaf glabrous. .... 51. *P. argyrocalyx*.
    - CC. Corolla disciform; base of the style pubescent; seeds short-caudate; upper surface of the leaves sparsely villose. .... 52. *P. wootonii*.
  - BB. Leaves strigose or hispid above; hypanthium incanous or slightly pilose, the hairs straight and appressed.
    - C. Pubescence on both surfaces of the leaves appressed.
      - D. Hypanthium slightly pilose, the epidermal tissue visible. .... 53. *P. occidentalis*.



- DD. Hypanthium thickly covered, the hairs incanous, the epidermal tissue obscured, the indumentum consisting of straight strigose hairs mixed with some weak crisp ones.
- E. Leaves ovate-oblong; corolla disciform. . . 54. *P. argenteus*.
- EE. Leaves lanceolate or ovate-lanceolate; corolla subcampanulate.
- F. Flowers white; base of the style glabrous; leaves canescent beneath. . . . . 55. *P. palmeri*.
- FF. Flowers purple-centered; base of the style hirsute; leaves sparsely pilose beneath. . . . . 56. *P. maculatus*.
- CC. Pubescence on the upper surface erect, hispid, mixed with some villose appressed hairs.
- D. Filaments of the stamens distinct; pubescence on the hypanthium and the lower leaf surface appressed.
- E. Leaves 10-18 mm. long, 5-8 mm. wide; corolla disciform; disc pubescent. . . . . 57. *P. stramineus*.
- EE. Leaves 5-10 mm. long, 2-4 mm. wide; corolla cruciform; styles and disc glabrous. . . . . 58. *P. pumilus*.
- DD. Filaments of 3 or 4 stamens united; pubescence on the lower leaf surface dense, long-villose, more or less erect and spreading. . . . . 59. *P. madrensis*.
- BBB. Leaves pilose or villose above, the hairs appressed; densely long-villose beneath, the hairs erect; hypanthium incanous, the hairs long-villose, straight or slightly curly. . . . . 60. *P. crinitus*.
50. *Philadelphus microphyllus* Gray in Mem. Am. Acad. Sci. II. 4: 54. 1849. — Walpers, Ann. 2: 614. 1851. — Port. & Coult., Synop. Fl. Colorado 41. 1874. — Anon. in Wien. Ill. Gart.-Zeit. 12: 435, fig. 86. 1887. — Nicholson in Gard. Chron. III. 2: 156, fig. 36. 1887. — Goldring in Garden 34: 134, [fig. 1]. 1888. — T[hompson] in Garden 40: 289, [pl. 1]. 1891. — Anon. in Gard. Chron. III. 11: 86, fig. 17. 1892; et 51: 225, fig. 101. 1912. — Dippel, Handb. Laubh. 3: 340. 1893. — Koehne, Deutsche Dendr. 184. 1893; in Gartenfl. 45: 506. 1896; et in Mitt. Deutsch. Dendr. Ges. 1904(13): 78. 1904. — Schneider, Ill. Handb. Laubh. 1: 365, fig. 234, e — f<sup>2</sup>. 1905. — Rydb. in N. Am. Fl. 22: 172. 1905. — [Weathers] in Gard. Album 1: 68, pl. 17. 1906. — Standley in Contr. U.S. Nat. Herb. 13: 190. 1910. — Clements, Rocky Mt. Fl. Pl. 31. 1914. — Armstrong, Field Book West. Wild Fl. 209. 1915. — Wooton & Standley in Contr. U. S. Nat. Herb. 19: 300. 1915. — Bean, Trees Shrubs 2: 139. 1914; ed. 7, 2: 416. 1950; et in Chitt., Dict. Gard. 3: 1546. 1951. — Moore in Bailey, Stand. Cycl. Hort. 5: 2582. 1916. — Rehder, Man. Cult. Trees Shrubs 279. 1927; ed. 2, 273. 1940; et Bibl. Cult. Trees Shrubs 194. 1949. — Engler, Pflanzenf. ed. 2, 18a: 193. 1930. — Tid. & Kitt., Fl. Ariz. N. Mex. 262. 1941. — McDougall and Sperry, Plants 88. 1947.
- Philadelphus microphyllus* var. *typicus* Koehne, Dendr. 185. 1893. — Schneider, Ill. Handb. Laubh. 1: 365. 1905.
- Philadelphus microphyllus* subsp. *typicus* Hitchc. in Madroño 7: 49. 1943. — Kearns. & Peebles, Ariz. Fl. 367. 1951.

TYPE: *A. Fendler* 266 (G).

A low, erect shrub up to a meter high with rather loose branches; bark of the second year's growth chestnut brown, shiny, exfoliating, the exposed portion ochraceous, striate, the current year's growth sparsely villose, the hairs all appressed; the flowering twigs 1.5–3, rarely up to 5 cm. long, with 3 or 4 pairs of leaves, the axillary buds enclosed. Leaves ovate-elliptic, elliptic or rarely sublanceolate, 1–1.5 cm. long, 5–7 mm. wide, entire and ciliate, when dry brown and glabrescent above, pale olive-brown, softly long-villose on the nerves or sometimes sparsely villose all over beneath, obtuse at the base, acute or obtuse at the apex, the petioles 2 mm. long, weakly villose. Flowers solitary, rarely 2, terminal, subtended by linear leaves; hypanthium campanulate, more or less villous at the base and sparsely so at the angles, the major part of the hypanthium and calyx glabrous, the sepals ovate-lanceolate, 5 mm. long, 3 mm. wide at the base; corolla cruciform, 3 cm. across, the petals obovate-oblong, rounded and erose at the apex, 1.5 cm. long, 9 mm. wide; stamens ca. 32, the filaments all distinct; disc and style glabrous, the style 1 mm. long, the upper third distinct, the stigmata 2 mm. long. Capsules globose, 7 mm. in diameter, the persistent calyx circumferential. Seeds ellipsoid, 2 mm. long including the tail, the testa castaneous, striately reticulate, the tail very short, about one eighth the length of the embryo.

UNITED STATES: **Colorado:** Fremont Co., Oak Creek Canyon, *R. C. Rollins* 1240 (G, MO, NY, US); Grand Canyon, Arkansas, *G. Engelmann & C. S. Sargent*, June 25, 1880 (A); Las Animas Co., Branth Canyon, *G. E. Osterhout* 2077 (NY); Mesa Verde National Park, *H. L. Zobel*, July 1, 1935 (MO). **Arizona:** Apache Co., Chile, *H. C. Culler* 2158 (G, MO); Luka Chukai Mt., *G. J. Goodman & L. P. Payson* 2843 (G, MO, NY); Navajo Reservation, *P. C. Standley* 7323 (US); *C. T. Vorhies* 109 (G); University of Arizona Herbarium, July 1916 (A, MO, NY). **Utah:** Carbon Co., Cottwood Canyon, *E. H. Graham* 9520 (MO); Grand Co., Post Canyon, *E. H. Graham* 9916 (F, G, MO); Moab, *M. E. Jones*, June 1, 1915 (NY); Wilson Mesa, *P. A. Rydberg & A. O. Garrett* 8380 (NY); La Sal Mt., *Maguire, Richard, Maguire & Hammond* 5803 (G, MO); Wayne Co., *H. Dixon* 205 (F). **Nevada:** Clark Co., Deadman's Canyon, *A. M. Alexander & L. Kellogg* 1785 (G, US); Lee Canyon, *I. W. Clokey* 8393 (A, NY). **New Mexico:** Bernalillo Co., Sandia Mts. Balsam Park, *C. C. Ellis* 107 (MO, NY, US); Cenigua Canyon, *Sister M. Marcelline* 2673 (F); Albuquerque, *E. J. Palmer* 31176 (A); Ellis Ranch, *E. O. Wooton*, Aug. 3, 1910 (US); Colfax Co., Ute Park, *P. C. Standley* 13295 (US); Pecos River National Forest, *P. C. Standley* 4547 (G, MO, NY, US); Sandoval Co., Sandia Mts., Guadalupe Canyon, *W. W. Eggleston* 18736 (US); Santa Fe Co., Santa Fe, *Bro. G. Arsene & Bro. A. Benedict* 15741 (F), 15742 (F, US); same area, *C. S. Sargent*, Sept. 4, 1894 (A); Santa Fe Creek, *A. Fendler* 266 (G, TYPE; A, F, NY, US, ISOTYPES); Santa Fe Canyon, *A. A. & Gertrude Heller* 3792 (A, F, G, MO, NY); *E. O. Wooton*, Aug. 6, 1910 (US); Santa Clara Canyon, *Sister M. Marcelline* 1852 (F); Water Canyon, *M. C. Wiegand & G. B. Upton* 3424 (F); Rito de las Frigales, *T. D. A. Cockerell*, Aug. 1912 (US); Socorro Co., San Mateo Mts., Beartrap Canyon, *W. W. Eggleston* 18654 (NY, US); San Mateo Peak, *E. A. Goldman* 1745 (US); Magdalena Mts., Water Canyon, *C. J. & Ruth Herrick*



202 (F); Taos Co., Taos River Canyon, *A. Nelson 11471* (G). **Texas:** Brewster Co., Chisos Mts., *R. S. Ferris & C. D. Duncan 2856* (MO, NY); *E. G. Marsh 101* (F); *J. A. Moore & Steyermark 3160* (A, G, MO); *C. Mueller 8013* (A, F, MO); *B. H. Warnock 866* (G, US).

**CULTIVATED:** Europe: Bot. Gard. Wien, *C. Schneider*, June 18, 1902 (A); Hort. Götting, *A. Rehder*, June 15, 1893 (A), June 25, 1896 (A); Bot. Gart. Forstakademie, Muenden, Hannover, *H. Zabel*, Aug. 23, 1884 (A), June 28, 1895 (A). United States: Arnold Arb. 544, June 27, 1904 (A).

This species was discovered in 1847 and as early as 1883 was introduced to Europe through the Lemoine Nursery in Nancy, France. I have examined a specimen of one of the earliest cultivated plants. It was collected by H. Zabel on Aug. 23, 1884 from the Botanischer Garten der Forstakademie, Muenden, Hannover. A note on this specimen, "Lemoine, 1883," indicates the approximate date and agent of the introduction of the species to Europe. Its dwarf habit and its apple-quince scented fragrance gave it popularity among growers there. By 1887 it could be found in many outstanding botanical gardens. Nicholson of Kew published an illustrated account of it in the *Gardener's Chronicle*. That same year a colored plate of it appeared in the *Wiener Illustrierte Garten-Zeitung*, which indicates its cultivation in Austria. By 1912 it was also reported to grow in gardens in Scotland. In the meantime European hybridists have taken advantage of its low compact habit and its pleasing fragrance. In 1887 the Lemoine Nursery put into the trade a new hybrid, *P. lemoinei*, which was announced as the result of a cross between the European *P. coronarius* Linn. and the American *P. microphyllus* Gray.

This species was first collected in the Santa Fe Creek of New Mexico. Its range extends north to the southern Rocky Mountains, west and northwest to the canyon lands and the Navajo section of the Colorado plateaus, reaching the Arizona portion of the Sonoran Desert, and south to the Texas portion of the Mexican highland. In the northern area of this range it has been reported to occur among *Juniperus* and *Pinus* at altitudes of 1540-2440 meters. There it grows in dry places at the base of granite cliffs or sandstone canyons, and its white, fragrant flowers appear in late June to mid-July. In New Mexico it grows at altitudes from 2200 to 3050 meters. In the southern portion of its range it has been reported to occur along dry streamlets at altitudes of about 1830 meters, and its flowers appear in June.

The type specimen of this species has small ovate-elliptic, elliptic, or even sublanceolate leaves which are obtuse at the base and almost glabrous on the upper surfaces. It has cruciform flowers with oblong petals which are about 1.5 cm. long. The specimens cited above possess these common features. Among the representatives of the wild population which I have examined, there are two varieties which can be recognized by their exceedingly narrow or unusually broad leaves. The leaves of these varieties are uniformly strigose or pilose above. In the broad-leaved form the corolla of the flowers is disciform and the petals are suborbicular.

KEY TO THE VARIETIES OF *P. microphyllus*

- A. Leaves linear-lanceolate, 2–3 mm. wide ..... var. *linearis*.  
 AA. Leaves ovate, 6–15 mm. wide, rounded at the base ..... var. *ovatus*.

50a. *Philadelphus microphyllus* var. *linearis*, var. nov.

Frutex, ramis cinereis, hornotinis castaneis, pilosis, deinde exfoliatis; foliis lanceo-linearibus, 10–16 mm. longis, 2–3 mm. latis, utrinque obtusis, supra tenuiter strigosis, subtus strigosis; hypanthiis calycibusque glabris vel glabrescentibus; disco glabro, stylo 2 mm. longo, stigmatibus 2.5 mm. longis, divisis.

ARIZONA: Tunitcha Mts., *E. A. Goldman* 2928 (TYPE, US).

This variety is distinguished from the typical *P. microphyllus* Gray by its linear leaves, which are uniformly 2–3 mm. wide and more or less strigose on both surfaces.

50b. *Philadelphus microphyllus* var. *ovatus*, var. nov.

Frutex, ramis cinereis, hornotinis castaneis, dense pilosis, deinde exfoliatis; foliis ovatis, 8–28 mm. longis, 6–15 mm. latis, basi rotundatis, apice obtusis, supra uniforme pilosis, subtus strigosis, vel villosis; floribus solitariis vel ternatis, hypanthiis basi pilosiusculis, sepalis glabris, corolla disciformi, 1.5–2.5 cm. diametro, petalis suborbicularibus, 6–10 mm. diametro; staminibus ca. 35; disco et stylo glabris; stylo 2 mm. longo, stigmatibus 3 mm. longis, divisis.

UNITED STATES: **Colorado:** Las Animas Co., northern slope of Mesa de Maya, *R. C. Rollins* 1835 (MO, NY, US). **Arizona:** Tunitcha Mts., *E. A. Goldman* 2913 (US). **Utah:** Grand Co., Moab, *M. E. Jones*, June 8, 1913 (F, G, NY, US); Juab Co., La Sal Mt., *C. A. Purpus* 6611 (MO, US); Marvin Laccolita, *M. E. Jones* 5663v (MO, NY, US); San Juan Co., *P. A. Rydberg & A. O. Garrett* 9608 (US); Uintah Co., Ashley Creek, *E. H. Graham* 6270 (MO, US). **New Mexico:** Bernalillo Co., Sandia Mts., *C. L. Herrick*, June 30, 1898 (US); Sierra Co., Hillsboro Peak, *O. B. Metcalfe* 1323 (A, TYPE; F, G, US, ISOTYPES); Socorro Co., Magdalena Mts., Copper Canyon, *E. A. Goldman* 1669 (US); Valencia Co., mountains west of Grant station, *E. O. Wooton* 1109 (NY, US).

This variety differs from the typical *P. microphyllus* Gray in its broader leaves, which are ovate and uniformly pilose above, and in its disciform corolla with suborbicular petals.

51. *Philadelphus argyrocalyx* Wooton in Bull. Torr. Bot. Club 25: 452. 1898. — Koehne in Mitt. Deutsch. Dendr. Ges. 1904 (13): 78. 1904. — Rydb. in N. Am. Fl. 22: 171. 1905. — Jones in Contr. West. Bot. 13: 11. 1910. — Standley in Contr. U. S. Nat. Herb. 13: 190. 1910. — Wooton & Standley in Contr. U. S. Nat. Herb. 19: 300. 1915. — Rehder, Man. Cult. Trees Shrubs 279. 1927; ed. 2. 273. 1940; et Bibl. Cult. Trees Shrubs 194. 1949. — Tid. & Kitt, Fl. Ariz. N.



Mex. 262. 1941. — Bean, *Trees Shrubs* ed. 7, 2: 411. 1950; et in Chitt., *Dict. Gard.* 3: 1545. 1951.

*Philadelphus serpyllifolius* var. Gray, *Pl. Wright.* 2: 64. 1853.

*Philadelphus ellipticus* Rydb. in *N. Am. Fl.* 22: 172. 1905. — Standley in *Contr. U. S. Nat. Herb.* 13: 190. 1910. — Wooton & Standley in *Contr. U. S. Nat. Herb.* 19: 300. 1915.

*Philadelphus serpyllifolius* var. *argyrocalyx* (Wooton) Jones in *Contr. West. Bot.* 12: 14. 1908.

*Philadelphus microphyllus* ssp. *argyrocalyx* (Wooton) Hitchc. in *Madroño* 7: 45. 1943, pro parte. — Kearns & Peebles, *Ariz. Fl.* 367. 1951.

TYPE: *E. O. Wooton 524* (US).

An erect shrub 1–2 m. tall, the branchlets grayish brown, fibrously striate, the second year's growth brown or castaneous, the bark closed, tardily exfoliate, the current year's growth brown, ferrugineous-villose, the hairs slightly thickened at the base, axillary buds enclosed. Leaves ovate, ovate-lanceolate or elliptic, 1–3.5 cm. long, 4–15 mm. wide, obtuse at the base, acute or obtuse at the apex, glabrous or glabrescent above, uniformly sparse strigose-villose beneath, the hair more or less erect, the petioles 1.5–2.5 mm. long, villose, the hair white. Flowers solitary, the pedicels 1–2 mm. long, densely long-villose; hypanthium subcampanulate, with the calyx thickly lanate, the sepals ovate-lanceolate, 7–8 mm. long, 3.5–4.5 mm. wide at the base, acuminate at the apex; corolla cruciform, 3.5 cm. across, the petals ovate-oblong, 15–17 mm. long, 10–14 mm. wide, rounded and emarginate at the apex; stamens ca. 55, the filaments united into bundles; disc and style glabrous, the style 3 mm. long, the stigmata 3.5 mm. long, the upper half separated, the fertile surface abaxial, linear. Capsules oblong-subglobose, 10–12 mm. long, 7–9 mm. in diameter, the persistent calyx circumferential. Seeds rather large, including the tail 3–4 mm. long, the testa castaneous, striately reticulate, the tail rather long, equal to or slightly shorter than the embryo.

UNITED STATES: New Mexico: Lincoln Co., White Mts., *E. O. Wooton*, June 30, 1895 (NY, US, PARATYPE); Eagle Creek, *E. O. Wooton 524*, Aug. 14, 1897 (US, TYPE); Nogal Canyon, *E. O. Wooton*, Aug. 17, 1901 (US); *L. C. Hinckley 1026* (F); El Capitan Mts., *F. S. & E. S. Earle 220* (MO); Otero Co., Lincoln Forest, *W. W. Eggleston 14541* (US); Mesilla Park, *J. D. Tinsley* in 1896 (US, TYPE of *P. ellipticus* Rydb.; NY, photo and fragment); vicinity of Cloudcroft, *E. O. Wooton*, July 29, 1899 (US); Sacramento Mts., Cloudcroft, *A. Rehder 372* (A); between Alamogordo and Cloudcroft, *A. Rehder 315* (A); Nogal Canyon, *W. Huber*, July 1, 1931 (F); Alamo National Forest, Head of Rio Fresnal, *B. Barlow*, Aug. 12, 1911 (F).

CULTIVATED: Arnold Arboretum 9044, *A. Rehder*, Oct. 1, 1918 (A), July 2, 1919 (A), July 20, 1927 (A).

Available material indicates that *P. argyrocalyx* Wooton has a very limited range of distribution. It is endemic to the isolated block mountains of south central New Mexico. There at altitudes of 2440–2590 meters it

is found as a shrub about one or two meters high. Its fragrant white flowers appear from late June to mid-August.

In the publication of this species Wooton cited four collections, but did not designate a type. Seventeen years later, in a joint work with Standley, he definitely indicated his second collection, numbered 524, as the type. This specimen was collected on Aug. 14, 1897. It was in fruit. Flowering material in the New York Botanical Garden bears on its label the same legend. This specimen is apparently not an isotype. It is probably a part of Wooton's first collection dated June 30, 1895, which is a paratype of this species. The other two specimens Wooton cited became the type material of *P. argenteus* Rydb.

*Rehder 372* also consists of different elements. Under this number one sheet in the Arnold Arboretum is a flowering specimen. It is true to the type of *P. argyrocalyx*. Under the same number there is another sheet in the Arnold Arboretum and one in the U. S. National Herbarium which are fruiting specimens. The capsules are evidently developed from flowers with pubescent discs. The seeds have short tails.

The glabrescent leaves and the large subcruciform flowers of *P. argyrocalyx* Wooton indicate its close affinity to *P. microphyllus* Gray. It can easily be distinguished from the latter species by its thickly lanate hypanthium and calyx. Its long-tailed seeds and oblong subglobose capsule with the circumferential persistent calyx suggest some kinship with *P. inodorus* Linn., but this relationship is rather distant. The character of connate filaments suggests a relationship with *P. palmeri* Rydb. It is highly probable that it is through these two species that a Mexican element, *P. maculatus* (Hitchc.) S. Y. Hu, is linked with the northern element *P. microphyllus* Gray.

This species was introduced into cultivation by A. Rehder, who in Aug. 1916 collected some seed from the south slope of the Sacramento Mountains near Cloudercroft, New Mexico. Plants from that lot of seed cultivated under the Arnold Arboretum field number 9044 flowered in early July 1919. Boston weather did not seem to alter the specific characters of this taxon. The density of the indumentum on the leaves and hypanthium, the shape of the corolla, the connate filaments, and the glabrous style of the cultivated specimen all resemble the type material. Through successive cuttings that introduction had been kept in the Arnold Arboretum for thirty years. Unfortunately the last plant was discarded in 1944. The plant now growing in the Arnold Arboretum under this specific name is one introduced from Kew in 1945.

## 52. *Philadelphus wootonii*, sp. nov.

Frutex ramulis castaneis, tarde exfoliatis, bienniis dense pilosis, hornotinis tomentosis, gemmis axillaribus tectis; foliis ovatis, 10–18 mm. longis, 5–9 mm. latis, utrinque acutis vel obtusis, supra sparse villosis, subtus dense strigoso-villosis, pilis erectis, petiolis 2 mm. longis, villosis; floribus solitariis, pedicellis 1–3 mm. longis, cum hypanthiis calycibusque lanatis.



hypanthiis subcampanulatis, sepalis ovatis, 3–4 mm. longis, basi 3 mm. latis; corolla subdisciformi, 2 cm. diametro, petalis ovatis, 8 mm. longis, 6–7 mm. latis; medio disci et basi styli hirsutis, stylo 2 mm. longo, stigmatibus 3 mm. longis, dimidiis apicibus divis; capsulis subgloboso-ellipsoideis, 7–8 mm. longis, 6–7 mm. diametro, calycibus persistentibus circumferentibus; seminibus breviter caudatis, cum caudis 3 mm. longis, testis castaneis, striato-reticulatis.

NEW MEXICO: White Mts., Gavilan Canyon, *E. O. Wooton*, July 23, 1905 (US, TYPE); Sacramento Mts., Cloudcroft, *A. Rehder* 372 (A, US, fruit).

Both in appearance and range this species appears to be similar to *P. argyrocalyx* Wooton. Apparently they are closely related species, though they can be easily distinguished. *Philadelphus argyrocalyx* Wooton has cruciform flowers, glabrous disc and style and long-tailed seeds. *Philadelphus wootonii* has disciform flowers, pubescent center on the disc and base of the style, and short-tailed seeds. The inclosed buds and the short-caudate seeds indicate that *P. wootonii* is a species of the *microphyllus* type which is somewhat influenced by the *mexicanus* or *coulteri* type with pubescent disc and style.

53. *Philadelphus occidentalis* Nelson in Bull. Torr. Bot. Club 25: 374. 1898. — Koehne in Mitt. Deutsch. Dendr. Ges. 1904 (13): 79. 1904. — Rydb. in N. Am. Fl. 22: 173. 1905.

*Philadelphus microphyllus* subsp. *occidentalis* (Nelson) Hitchc. in Madroño 7: 51. 1943, pro parte. — Kear. & Peebles, Ariz. Fl. 367. 1951.

*Philadelphus microphyllus* subsp. *stramineus* forma *zionensis* Hitchc., op. cit. 48.

TYPE: Wyoming, *R. A. Smith, Jr.* 3595 (Rocky Mountain Herb.).

A low shrub, the branches ochraceous, longitudinally fibrous-striate, the second year's growth castaneous, exfoliate, the current year's growth inconspicuously pilose, the hairs appressed. Leaves ovate or oblong-ovate, 10–20, rarely up to 25 mm. long, 5–11 mm. wide, obtuse or rounded at the base, obtuse or acute at the apex, entire, uniformly sparsely strigose-pilose on both surfaces, the hairs appressed. Flowers solitary or ternate, the pedicels 2 mm. long, strigose and incanous; hypanthium and sepals uniformly strigose-pilose, the epidermal tissue not obscured, the hairs appressed; sepals ovate, 4–6 mm. long, the apex acuminate; corolla disciform, 15–25 mm. across, the petals obovate, 5–10 mm. long, 4–8 mm. wide, the apex rounded; stamens ca. 35; disc and style glabrous, the style 1 mm. long, the stigma linear, 1.5 mm. long, slightly divided at the tip. Capsules subglobose-ellipsoid, 5 mm. long, 4.5 mm. in diameter, slightly pointed at both ends, the persistent sepals subapical. Seeds short-caudate, small, with the tail 1.5–2 mm. long, the testa light brown.

UNITED STATES: California: Inyo Co., Panamint Mts., Death Valley, *F. V. Coville & M. F. Gilman* 24 (US), 95 (US), 213 (US); Inyo Mts., Cerro Gordo

Peak, *A. M. Alexander & L. Kellogg* 3038 (G, US), White Mts., Wyman Creek, *I. Tidestrom* 9885 (A); same locality, *B. Maguire & A. H. Holmgren* 26038 (G, NY, US). **Wyoming:** Sweetwater Co., Rock Springs, *A. Nelson* 3595, July 15, 1897 (G, NY, US, ISOTYPES), July 15, 1898 (MO, US); same locality, *R. A. Smith* 6919 (G, MO, NY, US, ISOTYPE?). **Colorado:** Fremont Co., Royal Gorge, *R. Bacigalupi* 1009 (G, NY); same locality, *I. W. Clokey* 3791 (F, G, MO, NY, US); Arkansas Cañon, *J. H. Redfield* 456 (NY); Cañon City, *T. S. Brardegge* 84 (NY), June 1877 (F, NY); Garfield Co., Glenwood Spring, *E. J. Palmer* 38115 (A, F, MO, NY, US); *F. Wislizenus* 1041 (MO); *E. B. Payson* 1197 (MO); New Castle, *M. Cary* 153 (US); Gunnison Co., southwest of Sapinero, *R. C. Rollins* 51170; Moffat Co., confluence of Green & Yampa Rivers, *C. L. Porter* 3619 (G, US); Mesa Co., Gateway, *B. Maguire & G. Piranian* 12426 (G); Royal Gorge, *E. B. Payson* 1023 (MO); Gunnison Canyon, *E. B. Payson* 1056 (MO); Mesa Verde National Park, *E. B. Payson* 1137 (MO); Montrose Co., Grand Canyon, *F. H. Knowlton* 258 (US); Park Co., Webster Park, *E. A. Popenoe*, July 30, 1876 (MO, US); Colopasi, *E. L. Johnston & G. G. Hedgcock* 740 (NY); without precise locality, *D. E. Palmer* 309 (US); *H. D. Ripley & R. C. Barneby* 7157 (NY). **Utah:** Belknap, *S. G. Stokes*, June 12, 1900 (NY); Daggett Co., Manila, *B. Maguire & G. Piranian* 12379 (G); below Ashley Falls in Red Canyon of the Green River, *H. Cutler & M. Baker* (G, MO, NY); Gronse, *E. H. Graham* 8091 (MO); Grands Co., Thompson's Springs, *M. E. Jones* (G, US); Juab Co., Deep Creek Ranges, *B. Maguire & A. H. Holmgren* 21864 (G, MO, NY); Piute Co., Marysville, *M. E. Jones* 3575p (US), 5405j (US), 5904d (NY, US); Sevier Co., Burrville Canyon, *M. E. Jones* 5633 (A, NY, US); San Juan Co., *P. A. Rydberg & A. O. Garrett* 9609 (NY, US); Uintah Co., *A. O. Garrett* 7837 (F); Uintah Mts., Brush Creek Canyon, *L. N. Goodding* 1274 (G, NY); Uinta Basin, *E. H. Graham* 7454 (G, MO), 9145 (MO), 10015 (MO); Vernal, *B. F. Harrison & Larsen* 7761 (MO); Washington Co., Zions Canyon, *A. O. Garrett* R2269 (NY); *L. F. Ward* 699 (US); Zion National Park, *A. M. Woodbury* 19 (US); *O. Degener & L. Peiler* 16550 (NY); Warner Ranger Station, *Maguire et al.* 5802 (US). **Nevada:** Clark Co., Deadman's Canyon, *A. M. Alexander & L. Kellogg* 1779 (G). **Arizona:** Coconino Co., Grand Canyon, *W. P. Cottam* 2669 (A); *H. & V. Bailey* 1226 (A); Graham Co., Chiricahua Mts., *J. C. Blumer* 1303 (F, G, NY); Mohave Co., Grand Canyon, *J. W. Toumey* 133 (US); Santa Cruz Co., Huachuca, *L. N. Goodding* 147 (G, NY); Santa Rita Mts., *C. G. Pringle*, June 3, 1881 (F, US), July 13, 1881 (A, NY), June 2, 1884 (F); San Pedro River, *E. A. Mearns* 1540 (US); N. Arizona-S. Utah, *D. E. Palmer* 151 (G, MO, NY, US). **Texas:** Brewster Co., Chisos Mts., *V. L. Cory* 7077 (G); *V. Havard* 40 (G, US). **New Mexico:** Socorro Co., Hop Canyon of Magdalena Mts., *C. L. Herrick* 608 (US); Animas Peak, *E. A. Goldman* 1370 (US).

**MEXICO:** Chihuahua: San Luis Mts., Devil's Canyon, *E. A. Goldman* 1432 (US). Baja California: Sierra San Pedro Martir, *B. V. Meling*, July 30, 1931 (US).

In designating the type Nelson stated, "Collected first by the writer, but the excellent specimens, which are taken as the type, were secured by Robert Smith, Jr., from the same locality July 25, 1897, no. 3595." With the type material of this species distributed by the Rocky Mountain Herbarium, University of Wyoming, Laramie, I have seen three specimens with the following data: July 15, 1897, *Aven Nelson* 3595; July 15, 1898,



*Aven Nelson 3595*; July 1899, *R. A. Smith 6919*. None of these data agrees with Nelson's publication.

*Philadelphus occidentalis* is closely related to *P. microphyllus* Gray. It can be distinguished readily by its uniformly loose strigose-pilose hypanthium and its disciform corolla. In *P. microphyllus* the hypanthium is almost glabrous and the corolla cruciform.

53a. *Philadelphus occidentalis* var. *minutus* (Rydb.), stat. nov.

*Philadelphus minutus* Rydb. in N. Am. Fl. 22: 173. 1905.

*Philadelphus microphyllus* subsp. *occidentalis* Hitchc. in Madroño 7: 51. 1943, pro parte.

*Philadelphus nitidus* Nelson in Bot. Gaz. 42: 54. 1906. — Longyear, Trees Shrubs Rocky Mt. Reg. 124. 1927.

TYPE: Colorado: *C. F. Baker 266* (NY).

A divergently branched low shrub, the second year's growth castaneous, shiny, tardily exfoliate; leaves oblong to oblong-lanceolate, acute or obtuse at both ends, 10–17 mm. long, 2–5, rarely up to 7 mm. wide, very sparsely strigose-pilose above, uniformly strigose-pilose beneath, hairs appressed; flowers solitary, the corolla subcruciform, 13–17 mm. across, the petals oblong, 6–8 mm. long, 4–5 mm. wide; capsules small, subglobose, 4 mm. in diameter.

UNITED STATES: Colorado: Black Canyon, *C. F. Baker* (NY, TYPE; G, MO, US, ISOTYPES); same locality, *C. A. Purpus 511* (F); Grand Canyon National Park, *M. Gilstrap 13* (US). Utah: Sevier Co., Belknap, *M. E. Jones 6303* (MO, NY, US, PARATYPE of *P. nitidus* Nelson); without precise locality, *P. V. LeRoy 151* (NY). Nevada: Clark Co., Deer Creek, *I. W. Clokey 5485* (A, NY); Charleston Mountains, Lee Canyon, *A. A. Heller 10998* (A, F, G, MO, NY).

This variety can readily be distinguished from the typical *P. occidentalis* by its oblong-lanceolate leaves. Nelson observed this leaf character and described *P. nitidus* in 1906. One of his paratypes, *C. F. Baker 266*, was the type of an early binomial, *P. minutus* Rydb. Besides its narrow leaves, I can detect no appreciable difference between Rydberg's *P. minutus* and Nelson's *P. occidentalis*. I think Rydberg's species can be regarded only as a narrow-leaved variety of *P. occidentalis*.

54. *Philadelphus argenteus* Rydb. in N. Am. Fl. 22: 171. 1905. — Tid. & Kitt., Fl. Ariz. N. Mex. 262. 1914.

*Philadelphus argyrocalyx* var. *argenteus* (Rydb.) Engler, Pflanzenf. ed. 2, 18a: 193. 1930.

*Philadelphus microphyllus* var. *argenteus* (Rydb.) Kearns. & Peebles in Jour. Wash. Acad. Sci. 29: 480. 1939.

*Philadelphus microphyllus* ssp. *argenteus* (Rydb.) Hitchc. in Madroño 7: 42. 1943. — Kearns. & Peebles, Ariz. Fl. 367. 1951.

*Philadelphus microphyllus* ssp. *stramineus* (Rydb.) Hitchc. in op. cit. 47. 1943, pro parte. — Clokey in Univ. Calif. Publ. Bot. 24: 109. 1951, pro parte.

TYPE: *T. E. Wilcox*, July 1893, Fort Huachuca, Arizona (NY).

A xerophytic shrub, 1–2 m. high, branchlets gray, the second year's growth castaneous, slowly exfoliating, the current year's growth incanous. Leaves ovate or elliptic-oblong, 8–16 mm. long, 4–10 mm. wide, acute or obtuse at both ends, rarely the lower leaves of a branchlet rounded at the apex, uniformly weak-strigose above, incanous beneath, the hairs largely strigose, mixed with some crisp weakly villose ones, all appressed, the petioles 1–1.5 mm. long, incanous. Flowers solitary, the pedicels 1–1.5 mm. long, with the hypanthium and calyx incanous, the hairs largely strigose, appressed, obscuring the epidermis, the sepals deltoid, 5 mm. long, 4 mm. at the base, the apex acuminate; corolla disciform, 1.5–2.4 cm. across, the petals ovate, 6–10 mm. long, 5–10 mm. wide, sometimes sparsely pilose at the base outside; stamens ca. 46, the filaments separated; disc and style glabrous, the style 1 mm. long, the stigmata 4 mm. long, the upper third or half divided at anthesis. Capsules ellipsoid, 6 mm. long, 5 mm. in diameter, the persistent calyx subapical. Seeds oblong-ellipsoid, including the tail 2 mm. long, testa castaneous, striately reticulate, the tail very short, about one eighth the length of the embryo.

UNITED STATES: California: Inyo Co., Cerro Gordo Peak, *A. M. Alexander & L. Kellogg* 3038 (A), 3115 (A); same locality, *M. Kerr* 619 (A); Mono Co., White Mts., Black Canyon, *V. Duran* 540 (F, G, MO, NY); Riverside Co., San Jacinto Mts., *P. A. Munz* 8738 (G). Colorado: Grand River Canyon, Biltmore Herb. no. 5330 (A); Grape Creek Canyon, Herb. *E. A. Popenoe* 115 (A). Utah: Burrville Canyon, *M. E. Jones* 5633 (A, F, MO, NY). Nevada: Clark Co., Kyle Canyon, *I. W. Clokey* 5490 (NY); Griffith's Mine, *I. W. & C. B. Clokey* 7133 (NY); Deer Creek, *I. W. Clokey* 7540 (CU, F, MO, NY, US); same locality, *P. Train* 2178 (NY); Lee Canyon, *A. A. Heller* 10998 (A, US), *I. W. Clokey* 8486 (A, NY); Little Falls, *I. W. Clokey* 5487 (A); Trout Canyon, *P. Train* 2061 (A). Arizona: S. Colorado Mts., *J. G. Lemmon* 170 (G); Grand Canyon, *A. E. Hitchcock* 91 (US); Patagonia, *G. J. Harrison* 7180 (NY); Cochise Co., Bisbee, *J. I. Carlson*, May 31, 1913 (A, US); Fort Huachuca, *T. E. Wilcox*, June 1892 (NY), July 1893 (NY, TYPE; A, ISOTYPE), July 1894 (A, US); Superstition Mts., *G. J. Harrison* 6604 (NY); Santa Cruz Co., Santa Rita Mts., *C. G. Pringle* 13685 (G, NY). Texas: Trans-Pecos, *B. C. Tharp* 1439 (US); Brewster Co., Old Blue Grass Mts., *B. H. Warnock* 20894 (G); Culberson Co., Guadalupe Mts., McKittnick Canyon, *J. A. Moore & J. A. Steyermark* 3479 (A, G, MO, NY, US); Hudspeth Co., Sierra Blanca, *U. T. Waterfall* 6713 (G, MO); Jeff Davis Co., Davis Mts., Mt. Livermore, *L. C. Hinckley* 50 (F), 1170 (F), Aug. 27, 1939 s.n. (G); *E. J. Palmer* 34292 (A).

MEXICO: Baja California: Sierra San Pedro Martir, *I. L. Wiggins & D. Demaree* 4947 (F, NY, US); same locality, *E. A. Goldman* 1223 (US); Sonora: San Jose Mts., *E. A. Mearns* 1617 (US).

This species was first discovered at Fort Huachuca in southeastern Arizona. Its range, as indicated by additional collections, extends north-

eastward to the Sonoran Desert of southern Nevada and to the Sierra Nevada of eastern central California, northward to the Grand Canyon in Arizona and to central Utah and western Colorado, and southeastward to western Texas. Judging from the specimens I have examined, the center of concentration for this species is on the western and southeastern sections of its range. I have seen only a few specimens from the northern and eastern portions of this area.

In California it has been reported as a common shrub and grows on the ridges of the San Jacinto Mountains. In Nevada it has been reported to occur at altitudes between 2370 and 2750 meters. There it grows on gravelly hillsides among pines and junipers or on limestone cliffs. Its fragrant white flowers appear in July and August. In Arizona it occurs at altitudes between 2100 and 2800 meters, where flowering specimens have been collected in July. In Texas it occurs at altitudes between 2100 and 2300 meters, where flowering specimens have been collected as late as August.

From the type locality, Fort Huachuca, T. E. Wilcox collected specimens in June 1892, July 1893, and June 1894. The last-dated specimen in the United States National Herbarium is numbered 234. The other two are not numbered. His 1893 collection, deposited in the New York Botanical Garden, is the taxonomic type of the species.

The taxonomic status of *P. argenteus* Rydb. has been changed several times in the last fifty years. Engler interpreted it as a variety of *P. argyrocalyx* Wooton. Kearney and Peebles treated it as a variety of *P. microphyllus* Gray, and Hitchcock made it a subspecies of the latter. The differences existing between *P. argenteus* Rydb. and *P. microphyllus* Gray are comparable to those existing between *P. pubescens* Loisel. and *P. lewisii* Pursh. In both cases, there is a species with densely pubescent leaves, incanous hypanthium and pubescent calyx, and another species with these parts glabrous or glabrescent.

The affinity between *P. argenteus* Rydb. and *P. argyrocalyx* Wooton is closer, but they are distinct species. Both have white-hoary hypanthia and calyx. But the nature and density of the indumentum of these two species are very different. In *P. argenteus* the lower surface of the leaves is densely strigose with straight appressed hairs, covering some weaker crisp hairs, and the upper surface is strigose. The incanous hypanthium of this species has straight appressed hairs. In *P. argyrocalyx* the lower surface of the leaves has loosely arranged long-villose hairs, and the upper surface is glabrescent. The lanate hypanthium has woolly hairs. The leaves of *P. argyrocalyx* Wooton are in general much larger, measuring up to 3 cm. long.

The Nevada specimens cited above have been interpreted by Hitchcock & Clokey as *P. microphyllus* Gray ssp. *stramineus* Hitchc.

##### 55. *Philadelphus palmeri* Rydb. in N. Am. Fl. 22: 173. 1905.

*Philadelphus microphyllus* ssp. *argenteus* (Rydb.) Hitchc. in Madroño 7: 42. 1943, pro parte.



*Philadelphus madrensis* sensu Standl. in Contr. U. S. Nat. Herb. 23: 310. 1922, pro parte, non Hemsl.

TYPE: Mexico, Sierra Madre, *Edward Palmer* 2122 (G).

A shrub with fibrous gray branchlets, the second year's growth grayish brown, exfoliating, the current year's growth strigose-villose, the base of the hairs more or less thickened, axillary buds enclosed. Leaves lanceolate, 10–30 mm. long, 3–11 mm. wide, acute at the base, acute or subacuminate at the apex, uniformly sparse-pilose above, the hair appressed, densely strigose-pilose beneath, the hairs largely straight and mixed with some weak and crisp ones, all appressed, the petioles 1.5–2 mm. long, incanous. Flowers solitary, the pedicels 4 mm. long, with the hypanthium and calyx incanous, the hair all straight and appressed; sepals ovate, 5 mm. long, 3.5 mm. wide at the base, the apex acute; corolla subcampanulate, 2–2.5 cm. across, the petals oblong-obovate, 10 mm. long, 5–8 mm. wide, stamens ca. 23, the filaments united in 5 or more bundles, the disc and style glabrous, the style 1.25 mm. long, the stigmata 2–2.5 mm. long. Capsules turbinate, 4–7 mm. long, 5–7 mm. in diameter, the persistent calyx subapical. Seeds oblong ellipsoid, with the tail 2 mm. long, about one eighth the length of the embryo, the testa castaneous, striately reticulate.

UNITED STATES: Arizona: Chiricahua National Forest, *H. D. Burrall* 2079 (US), Chiricahua Mts., Cave Creek Canyon, *J. A. Kusche*, July 1927 (A). Texas: Mt. Livermore, *L. C. Hinkley* 1162 (F).

MEXICO: Coahuila: Sierra Madre, 40 miles south of Saltillo, *Edward Palmer* 2122 (G, TYPE; MO, ISOTYPE); Sierra de la Madera, Cañon del Agua, Cuatro Cienegas, *C. H. Muller* 3230 (A); Sierra de Parras, *C. A. Purpus* 4952 (F, G, MO, US); Nuevo Leon: Sierra Madre Oriental, Zaragoza, *F. G. Meyer & D. J. Rogers* 2993 (A, MO); Fraile, *Stanford, Retherford & Northcraft* 388 (A, MO).

Among the above-cited five collections, *Stanford et al.* 388 matches the type best. *Muller* 3230, on which the description of the fruits and seeds of the species is based, has broader leaves and looser indumentum. On the contrary, *Purpus* 4952 has much smaller leaves and denser tomentum. As a few broad leaves, like those of Muller's collection occur also on some healthy vegetative shoots of *Stanford et al.* 388, and a few small leaves like those of Purpus' collection are found also on the weak vegetative shoots of the same number, I have no doubt of the identity of *Muller* 3230 and *Purpus* 4952.

Standley in 1922 treated *P. palmeri* Rydb. as a synonym of *P. madrensis* Hemsl. Palmer's collection, with its lanceolate leaves, is very different from *Seemann* 2167, the type of *P. madrensis* Hemsl., which has ovate leaves densely white-pubescent with erect villose hairs.

#### 56. *Philadelphus maculatus* (Hitchc.) comb. nov.

*Philadelphus microphyllus* ssp. *maculatus* Hitchc. in Madroño 7: 44. 1943.

TYPE: *Stanford, Retherford & Northcraft* 695 (in University of Washington).

Shrub with slender branchlets, the second year's growth striate, the bark light brown, strigose-pilose, hardly exfoliating, wearing off in very small pieces; the current year's growth brown, strigose-pilose, the flowering shoots with 2 or 3 pairs of leaves, the axillary buds enclosed. Leaves lanceolate or elliptic-lanceolate, 1.5–2.5 cm. long, 3–6 mm. wide, acute or obtuse at the base, acute and mucronate at the apex, uniformly strigose above, weakly sparse-strigose beneath, the hairs denser on the principal nerves, the petioles 2–2.5 mm. long, more or less dorso-ventrally flattened. Flowers solitary, the pedicels 3–4 mm. long, incanous, the hypanthium obconic, 4-ridged, with the calyx dried purplish, sparsely but uniformly strigose-pilose; sepals ovate, 5–7 mm. long, 4 mm. wide at the base, the apex acuminate, the acumen up to 2 mm. long; corolla subcampanulate, ca. 3 cm. in diameter, the petals ovate, rounded and slightly notched at the apex, white and purple-spotted at the base, stamens ca. 40, the filaments more or less united; disc glabrous, the style 1–2 mm. long, sparsely strigose at the base, the stigmata 2 mm. long, columnar, 4-ridged, the receptive surfaces linear, abaxial. Capsules subglobose, ca. 7 mm. in diameter, the persistent calyx circumferential. Seed short-caudate, the embryo 1.25 mm. long, the tail ca. one-third as long, the testa dark brown.

UNITED STATES: Arizona: Mt. Kellogg, Santa Catalina Mts., *A. Rehder* 470 (A).

MEXICO: Tamaulipas: Miquihuana, *Stanford, Retherford & Northcraft* 690 (MO, NY, ISOTYPE). Nuevo Leon: Sierra Madre Oriental, Galeana, *C. H. & M. T. Mueller* 876 (A); *C. H. Mueller* 2213 (A, MO).

This distinct and interesting species occurs on the mountain-top southwest of Miquihuana. According to the collectors it is fairly abundant among the low vegetation in the forest of large pines. Its white and purple-centered flowers appear in early August. *Rehder* 470 from Arizona is a fruiting specimen. The pubescent style is very distinct. This specimen belongs here.

Hitchcock, the author of this taxon, interpreted it as a subspecies of *P. microphyllus* Gray and established its affinity with subsp. *argenteus* (Rydb.) Hitchcock. It is true that the current year's growth of this peculiar plant does have the enlarged nodes of the *P. microphyllus* type, and its hypanthium and calyx have straight appressed hairs like those of *P. argenteus* Rydb. But its four-ridged hypanthium also suggests relationship with *P. mexicanus* Schlecht., its columnar stigmata indicate affinity with *P. hirsutus* Nutt., and its pubescent style demonstrates kinship with *P. coulteri* Wats. It is probably an interspecific hybrid with the influences of all the above-mentioned species.

One of the most beautiful garden forms of *Philadelphus* at the Arnold Arboretum is the purple-heart *P. "Bicolore,"* a segregate of *P. × purpureo-maculatus* Lemoine. Recently Janaki Ammal made a study of the chromosome numbers of various cultivated *Philadelphus* species and found that "Bicolore" and a couple of its related forms have triploid chromosome numbers,  $3n = 39$ . She credited this triploid condition to human effort

involved in the cultivation and hybridization of the widely separated geographical races and concluded that "for the first time since Eocene times polyploidy has been induced in a genus which has remained diploid for millions of years in nature." An investigation into the chromosome set-up of this natural hybrid may change the above conclusion.

The purple-centered *Philadelphus* of northeastern Mexico was introduced in Ireland in the early part of the nineteenth century by some Irish miner and has been cultivated there under the garden name "Rose Syringa." Although the plant appears to be common in Tamaulipas, representatives of the native population have never been preserved in any herbarium until Stanford, Retherford and Northcraft made their collections. Unfortunately, due to the lack of specimens for comparison, the "Rose Syringa" of the Irish gardens had been misinterpreted by Nicholson & Burbidge as *P. coulteri* Wats. The latter species has white flowers and exposed axillary buds. The oldest herbarium specimen of the cultivated purple-centered *Philadelphus* that I have examined is dated June 6, 1905. It was collected at the Botanischer Garten de Forstakademie Muenden, Hannover. This specimen definitely has enclosed axillary buds, like *P. maculatus*. This morphological character leads me to assume that *P. maculatus* is the progenitor of, or is closely related to, the ancestors of our purple-centered triploid garden form.

The connate filaments and the lanceolate leaves of this species establish its real affinity with *P. palmeri* Rydb. The latter species can be distinguished by its densely incanous pubescence on the hypanthium and the lower surface of the leaves, and also by its glabrous style.

57. *Philadelphus stramineus* Rydb. in N. Am. Fl. 22: 172. 1905.

*Philadelphus microphyllus* sensu Jepson, Fl. Calif. 2: 140. 1936, pro parte, non Gray.

*Philadelphus serpyllifolius* sensu Fawcett, Fl. Rivers. Co. 62, 1938. — Sensu McMinn, Ill. Man. Calif. Shrubs 137, fig. 134. 1929, pro parte. — Sensu Abrams, Ill. Fl. Pac. St. 2: 385, fig. 2306. 1944, pro parte, non Gray.

*Philadelphus microphyllus* ssp. *stramineus* (Rydb.) Hitchc. in Madroño 7: 47. 1944. — Kearns & Peebles, Ariz. Fl. 366. 1951. — Clokey in Univ. Calif. Publ. Bot. 24: 109. 1951, pro parte.

TYPE: California, Mono Co., White Mts., W. H. Shockley, Aug. 1888 (NY).

A low shrub, the branchlets fibrously striate, ash gray or straw color, the second year's growth shiny castaneous, exfoliate, the current year's growth incanous, the axillary buds enclosed. Leaves ovate-lanceolate or ovate-oblong, 10–18 mm. long, 5–8 mm. wide, obtuse at both ends, olivaceous when dry, uniformly hirsute-hispid, with a mixture of appressed and erect hairs above, strigose-pilose beneath, the hairs all appressed, the petioles 1 mm. long, dorso-ventrally compressed, incanous. Flowers solitary, rarely ternate, the pedicels 2–3 mm. long, often with 2 basal linear bracts about 5 mm. long, 1 mm. wide; hypanthium and calyx incanous, the



hairs more commonly straight, less crisp, all appressed, the hypanthium subcampanulate, 3 mm. long, 4 mm. in diameter, the sepals ovate, 5–6 mm. long, 3 mm. wide at the base, the apex acuminate; corolla disciform, 15–18 mm. across, the petals ovate, 7–9 mm. long, 5–6 mm. wide, with a few hairs at the base on the back; stamens ca. 30, the filaments distinct; disc pubescent, the style 2.5 mm. long, the stigmata 3 mm. long, separated. Capsules ellipsoid, 7 mm. long, 6 mm. in diameter, the persistent calyx supermedian. Seeds short-tailed.

UNITED STATES: California: Mono Co., White Mts., *W. H. Shockley*, Aug. 1888 (NY, TYPE; A, F, US ISOTYPES); *B. Maguire & A. H. Holmgren 26038* (MO); Riverside Co., San Jacinto Mts., *E. C. Jaeger*, Aug. 16, 1922 (A, US). Nevada: Esmeralda Co., Goldfield, *A. A. Heller 10406* (A).

This taxon is morphologically and geographically intermediate between *P. pumilus* Rydb. and *P. argenteus* Rydb. The hispid upper surfaces of the leaves of this species suggest closer relationship with the former species. At first I interpreted it as a large-leaved variety of *P. pumilus*. But a careful examination of the type collection reveals that the flowers have pubescent discs. For that reason Rydberg's original specific status is kept here.

58. *Philadelphus pumilus* Rydb. in N. Am. Fl. 22: 173. 1905.

*Philadelphus serpyllifolius* sensu Hall in Univ. Calif. Publ. Bot. 1: 83. 1902. — Sensu Munz, Man. S. Calif. Bot. 220. 1935. — Sensu McMinn, Ill. Man. Cal. Shrubs 137. 1939, pro parte. — Sensu Abrams, Ill. Fl. Pac. St. 2: 385, fig. 2306, 1944, pro parte, non Gray.

*Philadelphus microphyllus* sensu Jepson, Fl. Calif. 2: 140. 1936, pro parte, non Gray.

*Philadelphus microphyllus* ssp. *pumilus* (Rydb.) Hitchc. in Madroño 7: 49. 1943.

TYPE: Southern California, San Jacinto Mountains, *H. M. Hall 2500* (NY).

A low, subspinescent shrub with fibrous striate gray branchlets, the second year's growth light brown, the bark closed, minutely pilose, the current year's growth brown, weakly villose, the hairs white, the axillary buds enclosed. Leaves oblong-elliptic, 5–10 mm. long, 2–5 mm. wide, obtuse at both ends, uniformly dense-hirsute with erect hairs mixed with a few longer appressed ones above, incanous with appressed straight strigose hairs mixed with some weak crisp ones beneath, the petioles 1–2 mm. long, dorso-ventrally compressed, incanous. Flowers solitary, the pedicels 1–1.5 mm. long, with the hypanthium and calyx incanous; hypanthium hemispherical, 2 mm. long, 3 mm. in diameter, the sepals ovate, 5 mm. long, 2.5 mm. wide at the base, acuminate at the apex; corolla cruciform, 14–20 mm. across, the petals oblong, 6–8 mm. long, 5 mm. wide, slightly hirsute at the base on the back, slightly notched at the apex; stamens ca. 45, the filament free; disc and style glabrous, the style 1.75 mm. long, the

stigmata 2.75 mm. long, the upper half separated. Capsules subglobose, 5 mm. in diameter, the persistent calyx circumferential. Seeds short-tailed.

CALIFORNIA: San Jacinto Mts., *H. M. Hall 2500* (NY, TYPE; A, MO, US, ISOTYPES); *E. C. Jaeger 451* (US).

The status of this xerophytic *Philadelphus* species of southeastern California has never been fully understood. Hall in 1896, 1897, and 1901 made trips to the San Jacinto Mountains and, in 1902, published a flora of that area. In that article his collections numbered 800 and 2500 were interpreted as *P. serpyllifolius* Gray, and he gave a general description of the taxon based on his no. 2500.

Hall's identification of this material was not based on careful comparison with Gray's type, and his determination was made on what he could "make out from Dr. Gray's descriptions." Unfortunately Hall's interpretation has been adopted in most of the floras or manuals of California plants published in the last two decades. The resemblance between the Californian xerophytic *Philadelphus* as represented by Hall's 2500 and Jaeger's 451 and *P. serpyllifolius* Gray is only superficial. Both taxa have dwarf habits, subspinescent twigs, small ovate-oblong or elliptic leaves, and short flowering branchlets, each of which has a solitary flower. But *P. serpyllifolius* Gray has exposed axillary buds, columnar stigmata, ecaudate seeds, and a kinky layer of tomentum under the long strigose hairs on the lower surface of the leaves, while the California plant has enclosed buds, separate stigmata, short-tailed seeds, and straight appressed hairs on the lower surface of the leaves. According to my interpretation of the genus they belong to two different subgenera. Rydberg in 1905 described *P. pumilus*, based on Hall's 2500, but he failed to mention that Hall had interpreted it as *P. serpyllifolius* in an earlier publication.

Jepson in 1936 gave, under the name *P. microphyllus* Gray, a description which fitted the Californian xerophytic forms, and he placed *P. pumilus* Rydb. and *P. stramineus* Rydb. as synonyms of Gray's species. Apparently this arbitrary treatment is not based on critical studies of the material representing these binomials. *Philadelphus microphyllus* Gray has glabrous sepals, a glabrescent hypanthium, and leaves almost glabrous above and sparsely villose beneath, while the California material has incanous hypanthium and sepals, and its leaves are hispid above and incanous beneath. The differences between these taxa are comparable to those existing between *P. lewisii* Pursh and *P. pubescens* Loisel., and these differences warrant specific rank for the plants.

*Philadelphus pumilus* Rydb. represents a plant which exists under extremely xerophytic conditions. Its incanous hypanthium and calyx with straight, appressed hairs mixed with some weaker, crisp hairs, and its incanous lower leaf surfaces with hairs of the same nature as those of the hypanthium suggest a close relationship with *P. argenteus* Rydb. It can easily be distinguished from the latter species by its hispid upper leaf surfaces.

**58a. *Philadelphus pumilus* var. *ovatus*, var. nov.**

Frutex foliis ovatis vel suborbicularibus, 3–7 mm. longis, 2–4 mm. latis, utrinque rotundatis vel obtusis, supra dense hispidis, pilis erectis; floribus solitariis, hypanthiis calycibusque incanis; corolla cruciformi, 12 mm. diametro, petalis oblongis, 6 mm. longis, 4 mm. latis, basi exterioribus glabris, disco et stylo glabro, stylo 1.5 mm. longo, dimidio diviso, stigmatibus clavatis, 2 mm. longis; capsulis globosis, 3 mm. diametro.

CALIFORNIA: Tacquitz Cañon, *E. C. Jaeger* 463 (US, TYPE; fragment A).

This variety is distinguished from typical *P. pumilus* Rydb. by its ovate or suborbicular leaves, glabrous petals, and divided styles.

**59. *Philadelphus madrensis* Hemsl. in Kew Bull. 1908: 251. 1908.**

*Philadelphus mexicanus* sensu Seemann, Bot. Voy. Herald. 294. 1856, non Schlecht.

*Philadelphus microphyllus* subsp. *argyrocalyx* Hitchc. in Madroño 7: 45. 1943, pro parte.

*Philadelphus microphyllus* subsp. *argenteus* Hitchc., op. cit. 42, pro parte.

TYPE: Mexico: Sierra Madre, Durango, *Seemann* 2167 (Kew; fragment & photo, A).

An erect shrub, old branches fibrously striate, the second year's growth castaneous, the bark exfoliate, the current year's growth strigose-villose, the hairs golden brown. Leaves ovate, those on the vegetative shoots 1.5–3.5 cm. long, 1–1.5 cm. wide, those on the flowering shoots 1–1.5 cm. long, 0.5–0.7 cm. wide, obtuse, rounded or obtuse at the base, acute at the apex, hirsute and strigose-villose above, the short hirsute hairs erect, the long villose hairs sometimes appressed, densely white-villose beneath, the hairs erect and sublanate. Flowers solitary or ternate; pedicels very short, ca. 1 mm. long, incanous, the hypanthium and calyx densely white strigose-villose, sometimes sublanate, the sepals ovate, 4 mm. long, apiculate-acuminate at the apex; corolla disciform, 2 cm. in diameter, the petals ovate-suborbicular, 1 cm. long, 8 mm. wide, the apex rounded and retuse, hirtellous on the lower and median portion of the back; stamens ca. 32, 6–7 mm. long, the filaments of 3 or 4 stamens united at the base; disc and style glabrous, the style 2 mm. long, the stigma linear, ca. 2 mm. long, the upper half divided. Capsules subglobose, 5 mm. in diameter, the persistent sepals almost circumferential. Seeds short and fat, very short caudate, the embryo 1 mm. long, the tail one fifth as long, the testa nigrescent.

UNITED STATES: Arizona: Mt. Graham, *Peebles, Harrison & Kearney* 4449 (US), 4450 (US); Pinaleno Mts., *R. A. Darrow*, Sept. 5, 1942 (MO); Chiricahua Mts., Barfoot Park, *J. C. Blumer* 1291 (F, G, MO, NY, US), 1303 (MO); *H. D. Burrall* 2079 (US); Rustler Park, *R. S. Ferris* 9923 (A, NY). New Mexico: Grant Co., the Burro Mountains, *O. B. Metcalfe* 173 (G, MO, NY, US);



without precise locality, *C. Wright 1101* (MO, NY); *A. H. Berkman & A. Lee 61* (G).

MEXICO: Chihuahua: Sierra Madre, between Rio Chico & Rio Caballo, *B. Barlow*, Sept. 29, 1911 (F), Sept. 30, 1911 (F; fragment A); *Colonia Juarez*, Sept. 12, 1903 (NY, US, fragment A); Durango, *Seemann 2167* (Kew, TYPE; photo & fragment, A); Salto Canyon, Babicora, *H. LeSueur*, July 23, 1937 (F, MO); Chuhuichupa, *H. LeSueur*, Sept. 4, 1936 (F, NY).

This interesting species was discovered in the Sierra Madre in northern Mexico. Its range extends to the Graham Mountains of Arizona and the Burro Mountains in New Mexico, where it occurs at altitudes of 1850–2440 meters. Flowering specimens have been collected from June to September. The dense, long villose erect hairs on the lower leaf surface and the hirsute erect hairs on the upper leaf surface of this species form a very convenient distinguishing character. Its very short caudate seeds suggest a distant relationship with *P. hirsutus* Nutt.

Some of the specimens from the Chiricahua Mountains of Arizona are not very typical of the species. There is a gradual decrease in the density of the hairs both on the lower leaf surface and on the hypanthium.

#### 60. *Philadelphus crinitus* (Hitchc.), stat. nov.

*Philadelphus microphyllus* subsp. *crinitus* Hitchc. in Madroño 7: 45. 1943.

TYPE: Texas, *E. J. Palmer 3434* (NY).

A low shrub 1–2 m. high, the branchlets brownish gray, longitudinally fibrous striate, the second year's growth castaneous, the bark closed, rarely tardily exfoliate, the current year's growth long-villose, the hairs more or less erect and sublanate. Leaves ovate or ovate-elliptic, 1–2 cm. long, 5–10 mm. wide, rounded or obtuse at the base, acute at the apex, entire, weakly villose above, moderately to densely villose or strigose-villose beneath, the hairs appressed. Flowers solitary, very rarely ternate, the pedicels 2 mm. long, long-villose; hypanthium campanulate, long-villose and sublanate, the sepals ovate, 6–8 mm. long, 3–4 mm. wide at the base, the apex acuminate, long-villose, incanous and sublanate; corolla campanulate-disciform, 1.5 cm. in diameter, the petals suborbicular, 6 mm. in diameter, both sides glabrous; stamens 48–74, the filaments free; disc and style glabrous, the style 1–1.5 mm. long, the stigmata linear, 3–4 mm. long, free at the apex. Capsules subglobose-ellipsoid, 7–9 cm. long, 6–7 mm. in diameter, the persistent calyx circumferential. Seeds short and fat, the embryo 1–1.5 mm. long, the tail about one fourth as long, the testa brown, reticulate.

UNITED STATES: Arizona: Santa Catalina Mts., Mt. Livermore, *L. C. Hinckley 513* (F); *Livingstone & Thornber*, May 8, 1906 (NY); *A. Rehder 244* (A); Mt. Kellogg, *A. Rehder 459* (A); *J. J. Thornber 7319* (NY). Texas: Jeff Davis Co., Davis Mts., Livermore Mt., *R. S. Ferris & C. D. Duncan 2529* (MO, NY); *E. J. Palmer 30860* (A), *30916* (A, MO), *31950* (A), *34347* (NY, TYPE; A, MO, US, ISOTYPES), *34364* (A, NY).

The thick white indumentum on the lower leaf surface of the above-cited specimens resembles that of *P. madrensis* Hemsl. Yet they cannot be placed in that species because of their glabrous petals, distinct filaments, and appressed hairs on the upper leaf surface. In *P. madrensis* the petals are pubescent on the back, the filaments of two, three, or four stamens unite into small bundles, and the hairs on the upper surface are erect. This species is also closely allied to *P. argyrocalyx*, but the leaves of the latter species are only sparsely villose.

Subgenus III. **Macrothyrsus**, subg. nov.

**Philadelphus** subg. III. **Macrothyrsus**, subg. nov.

*Philadelphus* Reihe 3. *Decorticatae cymosae* Koehne, Deutsche Dendr. 181. 1863, pro parte.

TYPE SPECIES: *P. californicus* Benth.

Flores paniculatae, hypanthiis plerumque glabris, corolla cruciformi, staminibus 25–37; ovario inferiore, stigmatibus liberis, clavatis; capsulis ellipsoideis, calycibus persistentibus subapicalibus, seminibus breviter caudatis.

Frutices erecti, ramulis castaneis, corticibus exfoliatis, gemmis axillari-bus expositis.

This subgenus is closely allied to the section *Stenostigma* of the subgenus *Euphiladelphus*. In fact, the type species of this subgenus, *P. californicus*, has been interpreted by many botanists as a variety of *P. lewisii* Pursh., a species of the section *Stenostigma*. The general appearance of these species is similar. But there are some essential differences between them which warrant placing *P. californicus* and its related species in a higher order. The first and most obvious character is the paniculate inflorescences, and the second but more fundamental one is the exposed axillary bud. In this respect the species of this subgenus show a strong trait which they have in common with the subgenera *Deutzioides* and *Gemmatus*.

Geographically, species of this subgenus are confined to the western flank of the northern and central portion of the Sierra Nevada in California. The northern end of this range overlaps with the southern periphery of the area of distribution of *P. lewisii*. As shown in Map 4, that species is concentrated chiefly in the area of the volcanic cones of the Coast Ranges in northwestern California, while species of this subgenus are found in deep ravines on the western side of the Sierra Nevada.

Section 6. **Californicus** Rydb., emend.

**Philadelphus** subg. III. **Macrothyrsus** sect. 6. **Californicus** (Rydb.), stat. nov.

*Philadelphus Californici* Rydb. in N. Am. Fl. 22: 162. 1905, in clavi, s. stat.

*Philadelphus* sect. *Poecilostigma* subsect. *Paniculati* Koehne in Gartenfl. 45: 451, 507. 1896; et in Mitt. Deutsch. Dendr. Ges. 1904 (13): 81. 1904, pro parte.

TYPE SPECIES: *P. californicus* Benth.

Character of the section as the subgenus.

#### KEY TO THE SPECIES

- A. Hypanthium and the exterior of the sepals glabrous; lower surface of the leaves on the flowering twigs glabrous; bark of the second year's growth castaneous, usually exfoliate.
    - B. Panicles composed of 3-, rarely 5-flowered simple cymes ..... 61. *P. californicus*.
    - BB. Panicles trichotomously decompound ..... 62. *P. cordifolius*.
  - AA. Hypanthium and the exterior of the sepals pubescent, the lower surface of the leaves on the flowering branches hirsute, rarely glabrous; bark of the second year's growth gray and closed, rarely brown and exfoliate. .... 63. *P. insignis*.
61. *Philadelphus californicus* Benth. in Pl. Hartw. 309. 1849. — Walp., Ann. 2: 614. 1851 — Torrey in U. S. Rep. Explor. Surv. Miss. Riv. Pacif. Oc. 4: 90. 1856. — Koehne, Deutsche Dendr. 181. 1893; Gartenfl. 45: 507. 1896, 52: 150. 1903; et Mitt. Deutsch. Dendr. Ges. 1904 (13): 81. 1904. — Rydb. in N. Am. Fl. 22: 164. 1905. — Schneider, Ill. Handb. Laubh. 1: 362, fig. 234a, a<sup>2</sup>, 236a. 1905. — Armstrong, Field Book West. Wild Fl. 209. 1915. — Rehder, Man. Cult. Trees Shrubs 272. 1927; ed. 2, 266. 1940; et Bibl. Cult. Trees Shrubs 191. 1949. — Abrams, Ill. Fl. Pac. St. 2: 385, fig. 2305. 1944. — Bean, Trees Shrubs ed. 7, 2: 411. 1950; et in Chitt., Dict. Gard. 3: 1546. 1951.
- Philadelphus lewisii* var. *parvifolius* Torrey in U. S. Rep. Explor. Surv. Miss. Riv. Pacif. Oc. 4: 90. 1856.
- Philadelphus lewisii* var. *californicus* (Benth.) Gray in Bot. Calif. 1: 202. 1876. — Hall & Hall, Yosemite Fl. 121. 1912. — Jepson, Fl. W. Mid. Cal. ed. 2, 210. 1911; Man. Fl. Pl. Calif. 465, fig. 460. 1925; et Fl. Cal. 2 (2): 139. 1936. — McMinn, Ill. Man. Calif. Shrubs 137, fig. 135. 1939.
- Philadelphus fremontii* Rydb. in N. Am. Fl. 22: 165. 1905.
- Philadelphus lucidus* Hort. ex Lavallée, Arb. Segrez, Enum. 115. 1877.
- Philadelphus gordonianus* var. *californicus* Koch, Dendr. 344. 1869.
- Philadelphus lewisii* sensu Dippel, Handb. Laubh. 3: 344, fig. 181. 1893.

TYPE: California, mountains of the Sacramento, *Hartwig* 1723 (Kew; ISOTYPES G, NY).

Erect shrubs up to 3 m. high, the bark of the second year's growth castaneous, exfoliate, the current year's growth glabrous. Leaves ovate or ovate-elliptic, those on the vegetative shoots 4.5–8 cm. long, 3–5 cm. wide; those on the flowering branches 3–5 cm. long, 2–3 cm. wide, rarely up to



8 cm. long, 4.5 cm. wide, glabrous on both surfaces, sometimes barbate in the nerve angles beneath, obtuse, acute, rarely rounded at the base, 3- or 5-nerved, acute at the apex, entire, ciliate or faintly serrate. Inflorescences paniculate, lateral cymes 3-, very rarely 5-flowered, the pedicels 3-15 mm. long, the bracts linear, 3-10 mm. long, ciliate, caducous; pedicels 4-5 mm. long, glabrous; hypanthium campanulate, glabrous; sepals ovate, 4 mm. long, 3 mm. at the base, glabrous; corolla cruciform, 2.5 cm. across, the petals oblong, 11 mm. long, 5 mm. wide, glabrous on both surfaces; stamens 25-37, the anthers oblong, mucronate at the apex; disc and style glabrous, the style 4 mm. long, undivided or sometimes slightly divided; stigmata clavate or oar-shaped, the adaxial surface equal to that of the abaxial one. Capsules ellipsoid, acute at both ends, 6-7 mm. long, 4-5 mm. in diameter, the persistent sepals supermedian, the seed ellipsoid and dorso-ventrally compressed, 1-1.5 mm. long, 0.5 mm. wide, the tail one fourth as long, the testa light brown.

UNITED STATES: California: Amador Co., Ione, *E. Branton* 1124 (MO, NY, US); Mokelumne Hill, *R. S. Ferris* 9851 (NY); Drytown, *G. Hansen* 226 (A, MO, NY); Butte Co., Chico, *A. Gray*, May 1885 (G); *A. A. Heller* 11875 (F, G, US); *E. Palmer* 2057 (US); *C. C. Bruce* 1785 (NY), 2057 (NY); Oroville, *L. S. Rose* 46423 (G, MO); Little Chico, *R. M. Austin* 1785 (NY, US); Magnolia, *L. Krautter*, June 2, 1905 (G); Calaveras Co., Calaveras Range Station, Stanislaus Forest, *W. W. Eggleston* 9445 (US); Humboldt Co., Alder Point, *A. Eastwood & J. T. Howell* 4739 (A); Mariposa Co., El Portal, *F. R. Fosberg* (G); Mendocino Co., *H. N. Bolander* in 1867 (US); *L. R. Abrams* 5959 (NY); Placer Co., Dutch Flat, *F. A. MacFadden* 12838 (NY); Colfax, *M. E. Jones* 3586 (A, NY, US); Shasta Co., McCloud River, *H. M. Evans*, May 30, 1924 (F); Redding, *A. A. Heller* 7957 (A, F, G, MO, NY, US); Pitt, *A. Eastwood* 1417 (G, US), 1417a (US); Pitt River, *L. E. Smith* 317 (A); Ingot, *A. Eastwood* 7887 (A); Montgomery Creek, *A. Eastwood* 652 (G, US); Tehama Co., Mill Creek, *W. W. Eggleston* 7351 (NY); Tulare Co., South Fork, Kaweah River, *Culbertson* 4481 (F, G, MO, NY); Middle Fork, Kaweah River, *C. S. Sargent*, Sept. 20, 1896 (A); Yuba Co., Feather River, *L. S. Rose* 39237 (NY, US); Tuolumne Co., Iron Canyon, *W. J. Williamson* 168 (NY); Yosemite Valley, *LeRoy Abrams* 4649 (A, G, NY); Herb. L. H. Bailey 347 (BH); *H. N. Bolander* 4890 (US); *W. M. Canby*, Aug. 14, 1895 (A); *H. M. Hall* 9111 (US); *H. M. Hall & E. B. Babcock* 3304 (NY, US); *C. C. Parry*, June 1881 (MO); *H. M. Evans*, Aug. 3, 1912 (F); Sequoia Park, *W. L. Jepson* 4656 (A); locality not definite, Upper Sacramento, *W. L. Jepson*, in 1894 (US); North Fork of the American River, Fremont 511 (NY, TYPE of *P. fremontii*, MO, ISOTYPE); Sierra Nevada, *John Muir* 4349 (NY); mountains of the Sacramento, *Hartwig* 1723 (G, NY, ISOTYPE); without precise locality, *R. M. Austin* (F); *H. N. Bolander* in 1866 (MO); *T. Bridge* 124 (A, NY, US), 125 (G, NY, US); *C. A. Purpus* 5582 (A, MO, US).

CULTIVATED: Europe: Kew, *G. Nicholson*, Sept. 28, 1882 (A); *Macklean* 421 (A); Hort. Bot. Berol., *E. Koehne* 465 (A, MO); *A. Rehder*, July 29, 1911 (A); Bot. Garten Forstakademie no. 40, *H. Zabel*, July 20, 1894 (A); Hort. Bot. Haun., Sept. 1936 (A); Hort. Münden, *A. Rehder* 2252 (A); Hort. Plantière, *C. K. Schneider*, June 26, 1906 (A). United States: Rochester, Highland Park no. 3, *Wm. L. G. Edson*, July 3, 1918 (A); *Mrs. R. E. Horsey*, July 5, 1918 (BH), Sept. 21, 1917 (BH).

The type was collected from the mountains along the Sacramento River, about fifty miles south of Chico. Additional material has extended its range to Shasta County in the north and Tulare County in the south. Its altitudinal range varies from 350 to 2440 meters. It is found abundantly in moist places in the *Quercus douglasii* belt associated with *Calycanthus* and *Toxicodendron*.

This species was introduced into European gardens in 1858. It is rarely found in American gardens.

62. *Philadelphus cordifolius* Lange, Forteg. Veter.-Landboh. Frilandstr. 66. 1871; et in Bot. Tidsskr. III. 2: 132, *pl.* 3. 1878. — Koehne, Deutsche Dendr. 181. 1893; in Gartenfl. 45: 507. 1896; et in Mitt. Deutsch. Dendr. Ges. 1904 (13): 81. 1904. — Rydb. in N. Am. Fl. 22: 164. 1905. — Schneider, Ill. Handb. Laubh. 366, *fig.* 234, *l-p*, 236, *f.* 1905. — Rehder, Man. Cult. Trees Shrubs 272. 1927; ed. 2, 266. 1940; et Bibl. Cult. Trees Shrubs 191. 1949.

*Philadelphus lewisii* var. *cordifolius* (Lange) Dippel, Handb. Laubh. 3: 344. 1893.

LECTOTYPE: *A. A. Heller 10784* (A).

An erect shrub about 2 m. high, the basal branches up to 5 cm. in diameter, the second year's growth reddish brown or gray, 5–7 mm. in diameter, the bark exfoliate, the current year's growth glabrous. Leaves ovate, 4–10 cm. long, 3–6 cm. wide, rarely smaller, both sides glabrous, occasionally very weakly barbate in the nerve angles beneath, entire, rounded or subcordate at the base, 3- or 5-nerved, acute or rarely shortly acuminate at the apex. Flowers in compound panicles, the lateral branches 7- or 9-flowered, the peduncles 10–20 mm. long, the rachillae 4–20 mm. long, the bracts lanceolate or linear, ciliate, caducous at anthesis, pedicels 2–4 mm. long, glabrous; hypanthium campanulate, glabrous, the sepals ovate, 6 mm. long, 3 mm. wide, the apex acuminate; corolla cruciform 3–3.5 cm. across, the petals obovate-oblong, 9–17 mm. long, 6–8 mm. wide, the apex rounded, both sides glabrous; stamens ca. 27; disc and style glabrous, the style 4 mm. long, the stigmata on 4 ridges, 3 mm. long, the apical half divided. Capsules small, ellipsoid, 5 mm. long, 5 mm. in diameter at the middle, pointed at both ends, the persistent sepals supermedianly attached. Seeds very small, the embryo subglobose to ellipsoid, 0.5–0.75 mm. long, the tail one fourth to one half as long, the testa brown or castaneous.

CALIFORNIA: Amador Co., *C. B. Wolf & B. D. Stark 5474* (G); *C. B. Wolf 5128* (A, BH); Butte Co., Oroville, *A. A. Heller 10784* (A, LECTOTYPE; F, G, MO, NY, US); Chico, *Mrs. J. Bidwell*, July 1878 (G); Calaveras Co., *G. Hansen 1803* (US); Mariposa Co., *F. R. Fosberg S5036* (NY); Tuolumne Co., Mother, *H. L. Mason 2127* (G); Stanislaus Canyon, *R. Stinchfield 123* (NY); *G. G. Coning*, June 10, 1884 (G); Yosemite Valley, *H. N. Bolander 4890* (G); *H. Y. Edwards*, July 1872 (NY); without precise locality, *V. Rattan 247* (US).

*Philadelphus cordifolius* was established on the basis of a cultivated plant of American origin. *A. A. Heller 10784* matches Lange's illustration and description and is selected as the lectotype.

Lange of Copenhagen in 1871 published *P. cordifolius* and in 1878 prepared a colored plate to illustrate the species, which he established on the strength of its large cordate-ovate leaves, up to 6.5 cm. long, and its large panicles with as many as thirty flowers. Rehder accepted this species in his last publication on the cultivated trees and shrubs. In the material of *Philadelphus* collected from California, the material cited above matches Lange's illustrations. The stems of these specimens are more robust, the leaves are larger, and the flowers are more profuse than those of the typical *P. californicus*. I suspect that they were collected from more vigorously growing plants of *P. californicus*. Lacking a field knowledge of this species, I hesitate to place Lange's species in the synonymy of *P. californicus*. This problem awaits the attention of Californian taxonomists.

I have not seen any cultivated material that can be named *P. cordifolius*. The plant labeled as such in the Arnold Arboretum does not belong here.

63. *Philadelphus insignis* Carr. in Rev. Hort. 1870: 40. 1870.—Koehne in Mitt. Deutsch. Dendr. Ges. 1906: 53. 1906.—Schneider, Ill. Handb. Laubh. 1: 367, fig. 236g. 1905.—Rehder, Man. Cult. Trees Shrubs 272. 1927; ed. 2, 266. 1940; et Bibl. Cult. Trees Shrubs 191. 1949.—Bean, Trees Shrubs ed. 7, 2: 415. 1950; et in Chitt. Dict. Gard. 3: 1546. 1951.

*Philadelphus billiardii* Koehne in Gartenfl. 45: 508. 1896.—Schelle in Beissner in Mitt. Deutsch. Dendr. Ges. 1905 (14): 18. 1905.

LECTOTYPE: Bot. Gard. Berlin, *E. Koehne 8* (MO).

An erect shrub, the bark of the second year's growth gray, closed, rarely brown and exfoliate, the current year's growth glabrous or sparsely pilose. Leaves ovate or ovate-elliptic, 3.5–8 cm. long, 1.5–6 cm. wide, obtuse, acute or rounded at the base, acute or shortly acuminate at the apex, subentire or faintly denticulate, uniformly strigose-pilose beneath or only occasionally on the principal nerves. Inflorescences paniculate, the lateral branches 3-flowered, the peduncles 8–25 mm. long, the bracts linear, 8 mm. long, pubescent; pedicels 3–5 mm. long, strigose-pilose, hypanthium and calyx strigose-pilose, sometimes nearly glabrous, sepals ovate, 7 mm. long; corolla cruciform, 2.5–3.5 cm. across, the petals oblong-obovate, 8–16 mm. long, 7–12 mm. wide; stamens ca. 30, the disc and style glabrous, the stigmata on elevated ridges, the apical half divided. Capsules ellipsoid, 6 mm. long, pointed at both ends. Seeds short-caudate, the embryo ellipsoid, 1.75 mm. long, the tail one fourth as long, the testa brown.

UNITED STATES: California: Amador Co., *R. S. Ferris 9851* (A, G); Butte Co., *R. M. Austin* (US); Fresno Co., Kings River Canyon, *A. Carpenter*, June 27, 1940 (G); Nevada Co., *A. M. Carpenter* (US); Shasta Co., *N. F.*



*Davis* 65 (NY); Tehama Co., Mill Creek, *W. W. Eggleston* 7351 (US); Tuolumne Co., *W. J. Williamson* 168 (US); locality not definite, near San Francisco, *A. Kellogg* 247 (= 2082), June 17, 1869 (MO). Oregon: Washington Co., *L. Constance & A. A. Beetle* 2765a (US).

CULTIVATED: Europe: Bot. Gard. *E. Koehne* 8 (MO, ISOTYPE of *P. billiardii* Koehne); Czersk, *O. Schütte* 1907 (US). United States: Hort. C. S. Sargent, *A. Rehder*, June 3, 1909 (A); Highland Park, Rochester, N. Y., *Mrs. R. E. Horsey*, June 28, 1918 (BH), Sept. 4, 1918 (BH). Arnold Arboretum 543, without collector, June 24, 1889 (A); *G. M. Merrill*, 4653, Sept. 26, 1921 (BH), June 23, 1922 (BH); without collector, June 22, 1903 (A), Oct. 3, 1916 (A).

*Philadelphus insignis* was established on the basis of a plant cultivated in Paris under the name "Souvenir de Billiard." Billiard was the distributor of the seed of that plant. About twenty-five years later Koehne gave the name *P. billiardii* to a plant bearing the same horticultural name. Ten years later he discovered the earlier name and made *P. billiardii* a synonym of *P. insignis*. Thus the material Koehne used as the basis for *P. billiardii* is almost true to the type of *P. insignis* Carr., and is selected as the lectotype for the species.

This species has long been regarded as a hybrid. In 1905 Schelle published a statement suggesting its parents as *P. latifolia* and *P. inodorus*. Rehder thought that it might be a hybrid of *P. pubescens* and *P. cordifolius* or *P. californicus*. The spontaneous Californian material cited above is not so uniformly pubescent as the cultivated specimens. The flowers are also smaller. Otherwise they match very well.

#### Subgenus IV. *Deutzioides*, subg. nov.

##### *Philadelphus* subg. IV. *Deutzioides*, subg. nov.

*Philadelphus* Reihe 4. *Decorticatae pauciflorae* Koehne, Deutsche Dendr. 180, 184. 1893, pro parte.

*Philadelphus* sect. 1. *Poecilostigma* subsect. 1. *Gemmai* Koehne in Gartenfl. 45: 450, 486. 1896; et in Mitt. Deutsch. Dendr. Ges. 1904 (13): 77. 1904, pro parte.

TYPE SPECIES: *P. hirsutus* Nutt.

Flores solitarii vel ternati; hypanthiis turbinatis, pubescentibus vel glabris; staminibus 13 usque ad 35, ovario valide inferiore, stigmatibus columnare vel subcapitato, non diviso, capsulis turbinatis vel subglobosis, calycibus persistentibus apicalibus raro circumferentibus; seminibus ecaudatis.

Frutices humiles; foliis serratis vel integris, valide trinerviis; gemmis axillaribus expositis.

Species of this subgenus are exclusively North American. There are eight species in three sections. Their distribution is shown in *Maps* 3 and 8.

Section 7. *Hirsutus* Rydb., emend.

*Philadelphus* subg. IV. *Deutzioides* sect. 7. *Hirsutus* (Rydb.), sect. nov.

*Philadelphus Hirsuti* Rydb. in N. Am. Fl. 22: 163. 1905, in clavi, s. stat.

*Philadelphus* sect. *Poecilostigma* Koehne subsect. *Gemmati* Koehne in Gartenfl. 45: 450, 1896; et in Mitt. Deutsch. Dendr. Ges. 1904 (13): 77, 1904, pro parte.

TYPE SPECIES: *P. hirsutus* Nutt.

Frutex humilis, ramulis gracilibus, cortice exfoliato; foliis ovatis vel ovato-ellipticis, serratis raro subintegris, utrinque pubescentibus; floribus ternatis vel solitariis; hypanthiis hirsutis vel glabris, staminibus 25 usque ad 35; disco et stylo glabris, stigmatum columnare; capsulis turbinatis vel subglobosis; seminibus ecaudatis.

Species of this section are concentrated in the southern portion of the Appalachian Highlands. Palmer's 1924 and 1928 collections extend the range of this section to the Ozark plateaus. The distribution of its species is shown in Map 3.

## KEY TO THE SPECIES

- A. Hypanthium more or less pubescent; leaves scabrous-hirsute above, uniformly villose beneath; corolla disciform with ovate or suborbicular petals ..... 64. *P. hirsutus*.
  - AA. Hypanthium glabrous; leaves strigose-pilose above, glabrous or with villose nerves or sparsely strigose beneath; corolla cruciform with oblong petals (except a small flowered var.) ..... 65. *P. sharpianus*.
64. *Philadelphus hirsutus* Nutt. Gen. N. Am. Pl. 1: 301. 1817. — P. W. Watson, Dendr. Brit. 1: pl. 47. 1825. — DC. Prod. 3: 206. 1828. — Sweet, Brit. Fl. Gard. 2: pl. 119. 1831. — Loudon, Arb. Frut. Brit. 2: 954, figs. 678, 678a. 1838. — Lindl. in Bot. Reg. 24: pl. 14. 1839. — Torr. & Gray, Fl. N. Am. 1: 595. 1840. — Hooker in Bot. Mag. 88: pl. 5334. 1862. — Anon. in Garden 40: 289. 1891. — Dippel, Handb. Laubh. 3: 345, fig. 182. 1893. — Nicholson, Kew Hand-list 1: 225. 1894; et ed. 2, 375. 1902. — Beadle in Small, Fl. 507. 1903; ed. 2, 507. 1913; et in Small, Man. 599. 1933. — Rydb. in N. Am. Fl. 22: 169. 1905. — Schneider, Ill. Handb. Laubh. 1: 364, fig. 234 c-d<sup>2</sup>, 235 a-e, 236 d. 1905. — Tarouca, Freiland-laubgehölze 383, fig. 350. 1913; et 257, fig. 306. 1930. — Rehder, Man Cult. Trees Shrubs 280. 1927; ed. 2, 275. 1940; et Bibl. Cult. Trees Shrubs 194. 1949. — Bean, Trees Shrubs 2: 413. 1950; et in Chitt. Dict. Gard. 3: 1546. 1951. — Gleason, Ill. Fl. 2: 273. 1952.
- Philadelphus villosus* Muhl., Cat. 48. 1813, nom. nud. — Rafin., Aut. Bot. 148. 1840. — Loud., Arb. Frut. Brit. 2: 954. 1838; et Hort. Brit. Suppl. 3: 606. 1850, in syn.

- Philadelphus hirsutus* var. *gracilis* (Schrader) DC., Prodr. 3: 206. 1828.  
*Philadelphus gracilis* Hort. ex DC., l.c., in syn. — Lubbock, Seedlings 1: 509, fig. 328. 1892.  
*Philadelphus trinervius* Schrader, Dicc. 4. 1827; et in Linnaea 12: 399. 1838.  
*Philadelphus trinervius* var. *gracilis* Schrader in Linnaea 12: 399. 1838.  
*Philadelphus pubescens* Bosc. ex Torr. & Gray, Fl. N. Am. 1: 595. 1840, in syn., non Loisel. 1820.  
*Philadelphus godohokeri* Kirchner in Petzold & Kirchner, Arb. Muscov. 202. 1864. — Koch, Dendr. 1: 346. 1869.  
*Philadelphus inodorus* var. *hirsutus* A. Wood, Am. Bot. Flor. 116. 1870.  
*Deutzia godohokeri* Hort. ex Nicholson, Kew Hand-list 1: 225. 1894; ed. 2, 375. 1902, in syn.

TYPE: *Nuttall 329* (duplicate in G, NY).

Low spreading shrubs with slender, slightly twisted, arching branches; the bark of the second year's growth castaneous, exfoliating; current year's growth villose, the axillary buds ovoid, acute at the apex, hirsute. Leaves ovate, ovate-elliptic or ovate-lanceolate, at the apex of vegetative branchlets 2.5–7.5 cm. long, 1–5 cm. wide, round at the base, acuminate or acute at the apex, uniformly scabrous-hirsute above, densely villose beneath with slightly curved trichomes, sharply serrate, those on the flowering twigs subentire with a few minute teeth. Flowers on very short shoots with 1 or 2 pairs of leaves, ternate or rarely 1 or 5, pedicels villose, 4–10 mm. or in cultivated specimens sometimes up to 20 mm. long, the long pedicellate one with 2 linear bracts 2–5 mm. below the hypanthium; hypanthium subcampanulate, villose; sepals deltoid, 4 mm. long, 3.5 mm. wide at the base, corolla disciform, 2.5 cm. across, the petals ovate, 1.2 cm. long, 1 cm. wide; stamens ca. 35, the longest 6.5 mm. long; style 4 mm. long, the stigma columnar, on 4 ridges of the united style, 2 mm. long, disk glabrous. Capsules turbinate or hemispherical, 5 mm. long, 5 mm. in diameter at the apical end, the persistent sepals apical, reflex. Seeds tailless, black, 1 mm. long, 0.5 mm. wide, the testa reticulate.

UNITED STATES: **North Carolina:** Buncombe Co., Bull Creek, Biltmore Herb. no. 4332d (NY); Madison Co., Hot Springs, Biltmore Herb. no. 4332 (A, G, MO, NY, US), 4332b (G, NY, US); French Broad River, *H. W. Ravenel* (NY); Polk Co., Columbus, *E. C. Townsend*, May 19, 1897 (CU, US); Rutherford Co., Chimney Rock, *Alexander, Everett & Pearson*, Sept. 27, 1933 (NY); same locality, Biltmore Herb. no. 4332a (NY), 4332c (A, G, MO, NY); mountains of North Carolina, *S. B. Buckley* (G, NY, US); *Wm. M. Canby*, Aug. 1876 (F, US); *G. R. Vasey* in 1878 (NY, US); without precise locality, *Chapman* (NY); Bernhardt Herb. (MO). **Georgia:** Dade Co., Sulphur Springs, *Pyron & McVaugh* 1138 (US); Floyd Co., Rome, *Alexander, Everett & Pearson* 2 (NY); *Pyron & McVaugh* 2648 (US); Murray Co., Fort. Mt., *Pyron & McVaugh* 2926 (US); Whitfield Co., *Cronquist* 5053 (G, MO, US); *R. M. Harper* 267 (G, NY, US), 274 (NY); *Kenesan Mts., Perry & Myers* 885 (G, NY). **Tennessee:** French Broad River, *S. B. Buckley* (G); *Nuttall 329* (ISOTYPE, NY, G); *T. H. Kearney* 721 (MO, NY, US); *Rugel* (NY); *C. S. Sargent* (A);



Knox Co., *H. M. Jennison* 304 (TENN), 328 (TENN), 718 (TENN), 1880 (TENN); *S. C. Tain*, April 24, 1925 (TENN); *Frank & Sarah Woods* 15395 (TENN); *F. Lamson-Scribner*, May 14, 1889 (NY); *A. Ruth* 257 (US), 261 (NY), 244 (G, NY), May 1895 (CU, F, MO, NY, US), June 3, 1933 (TENN); *F. H. Norris* 15398 (TENN); *A. B. Roger* 50 (F); Marbledale, *H. M. Jennison* 98 (TENN); *T. H. Kearney*, April 30, 1893 (F, US); Carter Co., *R. L. James* 16819 (TENN); Chatan Co., *H. Eggert*, Aug. 19, 1897 (MO); Cheatham Co., *E. J. Palmer* 35517 (A, F, MO, NY, US); *H. K. Svenson* 4222 (G); Cocke Co., *A. J. Sharp* 17915 (TENN); Franklin Co., *H. Eggert*, May 8, 1898 (MO, NY); Grainger Co., *Mary B. Wilson* (TENN); Hamilton Co., Chattanooga, *Florence Beckwith* 1016 (US); Roane Co., Kingston, *Alexander, Everett & Pearson* (NY); Sevier Co., Little River, *H. M. Jennison* 2203 (TENN); Unicoi Co., Nolichucky River, *Underwood, Harbison & Sharp* 3249 (TENN); Unaka Springs, *Virginia Cook* (TENN); Van Buren Co., Caney Creek Falls, *E. B. Harger* 7743 (G, TENN); Tennessee and Georgia border, Lookout Mt., *J. R. Churchill*, April 30, 1906 (G, TENN), May 6, 1906 (MO); Townsend, *R. K. Godfrey* (G); same locality, *J. B. Kinsey* (TENN); Coblerwood, *F. H. Sargent* 94 (US). Arkansas: Faulkner Co., *D. Demaree* 87 (MO); Van Buren Co., Shirley, *E. J. Palmer* 25174 (A, MO). Alabama: Blount Co., *H. Eggert*, June 20, 1897 (MO); *C. Mohr*, June 26, 1895 (A), May 13, 1898 (A, US); Delkalb Co., *T. G. Harbison* 55 (A), 5905 (A), May 15, 1899 (A); *Miss Loring*, May 1899 (US); Franklin Co., Russellville, *L. James* 10 (MO); Jefferson Co., Birmingham, *E. J. Palmer* 38939 (A, MO); Lauderdale Co., Florence, *C. Mohr*, June 2, 1892 (A), June 6, 1892 (MO, NY, US); Tuscaloosa Co., Black Warrior River, *E. J. Palmer* 35391 (A, MO, NY, US); without precise locality, *S. B. Buckley* 1892 (MO).

CULTIVATED: Europe: Kew, *G. Nicholson* 1321 (A), 3131 (A); Lindley, July 9, 1838 (G); Hort. Bot. Cantab. 1844 (G), 1849 (G); *J. T. Rothrock* (F); *W. B. Basit* 1842 (NY); Hort. Bot. Wien, *C. K. Schneider*, June 20, 1902 (A); Bot. Gart. Forstakademie no. 7, *H. Zabel*, June 17, 1873 (A); Hort. Münd, *A. Rehder* 1600 (A); Bot. Gart. Darmstadt, *Purpus*, June 8, 1924 (A). United States: Arnold Arboretum 2213-1 = 542-1, *A. Rehder*, s.n. (A); 2213-2 = 15358, without collector, June 6, 1906 (A); 2213-3 = 15365, without collector, June 6, 1906 (A), June 7, 1916 (A); 561-28, *E. J. Palmer*, June 10, 1938 (A); Bot. Gard. Cambridge, *J. G. Jack*, June 9, 1902 (A).

*Philadelphus hirsutus* was discovered by Nuttall on the rocky banks of the French Broad River in Tennessee and was introduced into European gardens in the early nineteenth century under several garden names. The one most widely used was *P. gracilis* Hort. A. P. DeCandolle in 1828 took over this trade name and made it a variety of *P. hirsutus*. He differentiated this variety as having three-nerved leaves. Regarding the venation of this taxon, like that of all the other species of *Philadelphus*, the number of the principal nerves varies with the size of the leaves, which in turn depends largely upon the vigor of the shoot. The leaves on the strong growth of a plant are larger, the two side nerves branch near the base, and the leaves appear five-nerved, while the leaves on the weaker growth are smaller, the branching of the side nerves is less conspicuous, and the leaves appear three-nerved. Sweet, as early as 1831, interpreted the trade name *P. gracilis* Hort. as a synonym of *P. hirsutus*. His colored

plate represents the typical form of this species, and his interpretation is right.

Schrader was handicapped by not having seen any American specimen, and his concept of *P. hirsutus* was a mistaken one, due to his overemphasis on the form and dentation of the margin of the leaves, which he understood to be oblong-ovate and sharply and narrowly serrate. When he actually saw some material belonging to this American species, he described the larger plant as *P. trinervius* and a weaker one as *P. trinervius* var. *gracilis*.

*Nicholson* 1321 and 3131 are labeled *P. godohokeri* Hort. and *Deutzia godohokeri* Hort. They are typical *P. hirsutus* Nutt. These specimens prove that the *P. godohokeri* of authors in the late 1800's belongs here.

In American gardens *P. hirsutus* was introduced into cultivation as early as 1880, when A. Gattinger sent some seeds from Nashville to the Arnold Arboretum, cultivated as 2213-1 = 542-1. In 1906 the Biltmore Arboretum also sent the Arnold Arboretum some cuttings which were cultivated as 2213-3 = 15365. Palmer sent a plant from Shirley, Arkansas, to the Arnold Arboretum on April 7, 1928. This was cultivated as no. 561-28, and marks the latest introduction of this species into gardens.

The center of distribution of this species is doubtlessly the southern Appalachian Mountain area, chiefly along the Tennessee River and its tributaries. There it grows along the limestone ledges and bluffs or in jumbled standstone-quartzite rocks. The few specimens collected on the Ozark Plateau are from the periphery of its range. Its white flowers appear from middle April to late May in the wild. In cultivation it is perfectly hardy in the climate of Boston. In the garden it forms a low compact shrub about 1.5 meters high with arching, spreading branches which tend to twist around each other. Those that touch the ground root readily. In the Arnold Arboretum collection of *Philadelphus* this species is one of the early bloomers.

The typical *P. hirsutus* has uniformly pubescent hypanthia and sepals. Specimens with glabrous sepals, and hypanthia pubescent only at the basal ends are interpreted as natural varieties of this species.

#### KEY TO THE VARIETIES OF *P. hirsutus*

- A. Flowers 3 cm. across; fruit 6 mm. across the top. . . . .a. var. *intermedius*.  
 AA. Flowers 1.5-2 cm. across; fruit 3-4 mm. across the top. . . . .b. var. *nanus*.

#### 64a. *Philadelphus hirsutus* var. *intermedius*, var. nov.

Frutex, foliis ovatis, subintegris, serratis vel crasso-serratis, supra scabro-hirsutis, subtus aequabiliter villosis; floribus ternatis, basi hypanthiis pilosiusculis, corolla disciformi, 3 cm. diametro, petalis oblongo-suborbicularibus, 12-15 mm. longis, 10-12 mm. latis; capsulis turbinatis, 5 mm. longis, apice 6 mm. diametro.

UNITED STATES: North Carolina: Warm Springs, French Broad River, J. D. Smith, May 26, 1880 (fr. TYPE, US); "mountains of Georgia," A. W. Chap-

*man* 877 (F, US). **Tennessee:** Bledsoe Co., *H. K. Svenson* 10175 (MO, TENN); Franklin Co., *H. Eggert*, May 8, 1898 (US, NY); Knoxville, *A. Ruth*, April 1894 (US), May 1895 (NY, US); Van Buren-Bledsoe Co., Cumberland Plateau, Fall Creeks Fall Gorge, *H. H. Iltis* 3206 (TENN).

The indumentum of the leaves of this taxon resembles that of *P. hirsutus* Nutt., but the density of the hairs on the hypanthium is much reduced. In this respect it demonstrates an evolutionary tendency toward *P. sharpianus* S. Y. Hu.

64b. *Philadelphus hirsutus* Nutt. var. *nanus*, var. nov.

Frutex, foliis ovatis, subintegris, supra strigoso-pilosis, subtus aequaliter villosis, floribus 1 vel 3, basi hypanthiis pilosiusculis, corolla parva, 1.5–2 cm. diametro, petalis ovatis, 5–7 mm. longis, 5 mm. latis; capsulis turbinatis, 3–4 mm. longis et latis; seminibus oblongo-ellipsoideis, 1 mm. longis, 0.5 mm. latis, testis reticulatis, nigrescentibus.

UNITED STATES: **Tennessee:** Blount Co., Abrams Creek, *H. M. Jennison* 3824 (TYPE, TENN; fragment, A); Davison Co., near Nashville, bluff on Cumberland River, *A. Gattinger* (Curtiss no. 838 US; fragment, A).

This small-flowered variety shows relationship with *P. serpyllifolius* Gray. Gattinger ex Curtiss no. 838 is a mixture of elements belonging to different categories. That in the United States National Herbarium definitely belongs here.

65. *Philadelphus sharpianus*, sp. nov.

Frutex ca. 3 m. altus, ramis cineraceis, bienniis castaneis, 1.5 mm. crassis, exfoliatis, hornotinis 1 mm. diametro, strigoso-villosis, gemmis axillaribus ovoideis, apice acutis; foliis ovatis vel ovato-ellipticis, 3–7.5 cm. longis, 1–3.5 cm. latis, basi obtusis, raro rotundatis, apice acutis vel acuminatis, supra strigoso-pilosis, subtus a nervis sparse villosis, aliter glabris, argute serratis, petiolo 2–10 mm. longo; floribus ternatis, raro 1 vel 5, pedicellis 1–2 cm. longis, villosis, bracteolis 2, pedicellis 1–2 cm. longis, villosis, bracteolis 2, linearibus, ciliatis; hypanthiis calycibusque glaberrimis, hypanthiis obovoideis, 4 mm. longis, sepalis ovatis, 4 mm. longis, basi 3 mm. latis, acuminatis, ciliatis; corolla cruciformi, 2.5–3 cm. in diametro, petalis oblongis, 1.5 cm. longis, 8–10 mm. latis; staminibus ca. 25, antheris oblongis, disco glabro, stylo 4 mm. longo, glabro, stigmatibus columnari, 2 mm. longo; capsulis subglobosis, 6 mm. longis, 5 mm. diametro, calycibus persistentibus apicibus, reflexis, seminibus minutis, 1.5 mm. longis, testis nigrescentibus, reticulatis.

UNITED STATES: **Tennessee:** Great Smoky National Park, mouth of Mills Creek, lower end of Abrams Creek, *A. J. Sharp* 278 (fruit, TYPE, TENN; fragment, A); Anderson Co., Lake City, *Sharp & Cain* 336 (flower, TYPE, TENN; fragment, A); Norris, *W. W. Varnell*, May 15, 1937 (TENN); Roane Co., bluff near Harriman, *Underwood & Sharp* 2016 (TENN, fragment, A). **Arkansas:** Van Buren Co., Red River near Shirley, *E. J. Palmer* 24308 (A).



CULTIVATED: Arnold Arboretum no. 18346, *E. J. Palmer*, Oct. 16, 1936 (A), June 6, 1938 (A).

The distribution of this glabrous species seems to be limited to a few counties in the Great Smoky Mountain area and Van Buren County in Arkansas. It grows on sandstone ledges or river bluffs as a shrub about 10 ft. high. Its white flowers appear in late April or mid-May. Obviously it is closely related to *P. hirsutus* Nutt. From the latter species it can be readily distinguished by its glabrous hypanthium and sepals, cruciform flowers and oblong petals.

In April 1924 Mr. E. J. Palmer sent to the Arnold Arboretum a living plant no. 25174, from Shirley, Arkansas. This plant has been cultivated under the Arnold Arboretum number 18346. It has glabrous hypanthia and sepals, and it definitely belongs here. The herbarium specimens collected by *E. J. Palmer* and deposited in the herbaria of the Arnold Arboretum and the Missouri Botanical Garden, numbered 25174, represent the true *P. hirsutus* Nutt.

After the manuscript on this species was prepared I received from Mr. Palmer, on May 14, 1954, a portion of his unpublished notes on the trees and shrubs of North America. His interesting account of the discovery of this species is quoted as follows:

"While collecting along the Little Red River near Shirley, Arkansas, on May 28th, 1924, I came upon a *Philadelphus* growing sparingly along the sandstone ledges of the river bluffs. The plants were all small shrubs a meter or less in height and some of the slender branches were pendulous over the rocky ledges. From the habit and vegetative characters I suspected that it was *Philadelphus hirsutus* Nutt., a plant of the southern Appalachians and the piedmont regions from North Carolina and Georgia to Tennessee. Living plants were collected and herbarium specimens were made, but as the flowers had already withered, they were not in good condition for study. On March 31st, 1928, I again visited the locality on a collecting trip with Dr. D. M. Moore and Professor Delzie Demaree of the University of Arkansas. It was then too early in the season to make specimens of the *Philadelphus*, but additional rooted plants were sent to the Arnold Arboretum, where plants from both collections are now growing, and where they flowered freely last year.

"The plant sent in 1928 proves to be *Philadelphus hirsutus*, and this shows a considerable westward extension of its range and the first record, so far as I am aware, from Arkansas or from west of the Mississippi River, although specimens of *Philadelphus pubescens* have sometimes been confused with it.

"The first collection of 1924, although resembling *Philadelphus hirsutus* in foliage and habit and clearly related to it in such characters as the hirsute pubescence of the foliage and branchlets and the short club-like styles, differs so strikingly in other characters of the flowers that it must be regarded as distinct. . . . In typical *Philadelphus hirsutus*, as it grows here and as shown by numerous herbarium specimens and in the excellent

illustration in the Botanical Register, 1839, pl. 14, the petals are broadly ovate and about as broad as long, overlapping at the base when the flowers are fully expanded, and the calyx and ovary are covered with hirsute pubescence. In the new variety the petals are much narrower, oblong or oblong-ovate, slightly emarginate at the apex, and not meeting at the edges, and the calyx and ovary are glabrous. The flowers appear to be slightly smaller than in the typical form and the pedicels longer, up to fully two centimeters in length."

65a. *Philadelphus sharpianus* var. *parviflorus*, var. nov.

Frutex, foliis ovatis, serratis, supra sparse pilosis, subtus sparse strigoso-pilosis; floribus ternatis, raro 5, pedicellis 7–15 mm. longis, sparse pilosis, bracteis linearibus, ciliatis, hypanthiis calycibusque glabris, corolla disciformi, 1.5 cm. diametro, petalis suborbicularibus, 7 mm. diametro.

UNITED STATES: Tennessee: *A. Gattinger*, May 1878 (TYPE, NY; fragmen-  
tary, A).

The shape of the corolla of this small-flowered variety resembles that of *P. hirsutus* Nutt., but its glabrous hypanthium and the pilose upper leaf surface indicate a closer relationship with *P. sharpianus*. Thus it is treated as a variety of the latter species.

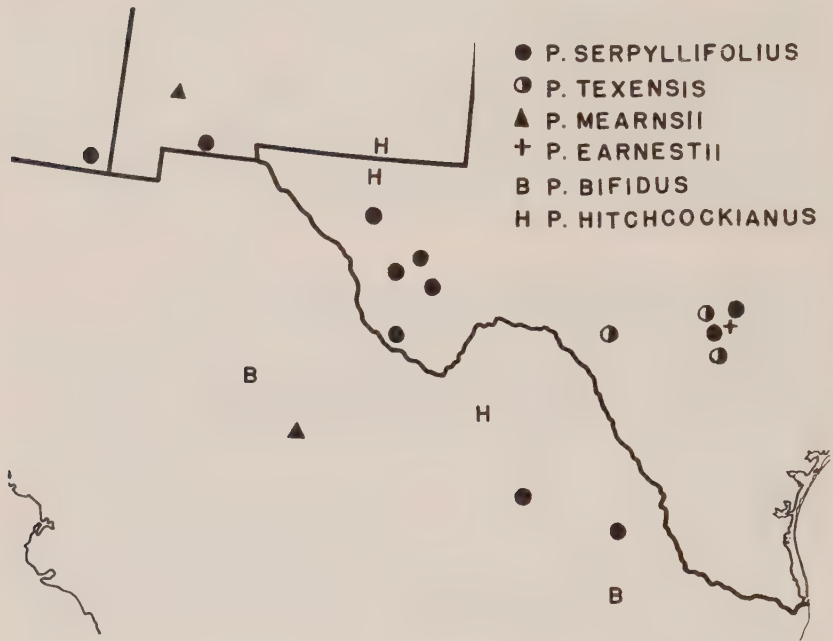
Section 8. *Pseudoserpyllifolius*, sect. nov.

*Philadelphus* subg. IV. *Deutzioides* sect. 8. *Pseudoserpyllifolius*,  
sect. nov.

Frutices humiles; ramulis floriferis brevibus; foliis parvis, integris, subtus strigosis vel strigoso-villosis, non lanatis; floribus solitaris, flore cum foliis apice calcaratis fasciculatis, pedunculis brevissimis, 1–1.5 mm. longis; hypanthiis pubescentibus vel glabris; corolla stellata vel disciformi; stylo brevissimo, 0.7–1 mm. longo, stigmate columnari; fructibus globosis vel subglobosis; seminibus ecaudatis.

TYPE SPECIES: *P. mearnsii* Evans ex Rydb.

Species in this section are xerophytic, like those in the section *Serpyllifolius*. They all have spinescent or calcarate branchlets, small entire leaves, solitary flowers with very short style, united stigmata, small fruits and ecaudate seeds. The principal difference between these two sections lies in the nature of the indumentum on the lower surface of the leaves. In section *Serpyllifolius* the lower surface of the leaves is strigose with an underlying kinky layer, while in section *Pseudoserpyllifolius* that kinky layer is absent. The range of this section is as shown in *Map 8*.



MAP 8. The distribution of the species of *Philadelphus* in sections *Pseudoserpyllifolius* and *Serpyllifolius*.

#### KEY TO THE SPECIES

- A. Hypanthium pubescent; pubescence on the surface of the leaves various.
- B. Upper surface of the leaves pilose, the hairs appressed; corolla stellate or disciform; fruit 2–5 mm. in diameter.
  - C. Fruit small, hemispherical, 2 mm. in diameter; corolla stellate, the petals oblong-lanceolate, 2–3 mm. wide; bark of the second year's growth castaneous, exfoliating; leaves oblong-lanceolate, 2–5 mm. wide. ....66. *P. mearnsii*.
  - CC. Fruit subglobose, 4–5 mm. in diameter; corolla disciform, the petals suborbicular, 6–7 mm. wide; bark of the second year's growth brownish gray, not exfoliating; leaves ovate, 8–13 mm. wide. ....67. *P. earnestii*.
  - BB. Upper surface of the leaves scabrous-hirsute, the hairs erect; corolla cruciform, the petals 5–6 mm. wide; fruit 6–7 mm. in diameter; leaves ovate or ovate-lanceolate. ....68. *P. bifidus*.
  - AA. Hypanthium glabrous; leaves strigose on both surfaces, the hairs appressed. ....69. *P. hitchcockiana*.
- 66. *Philadelphus mearnsii* Evans ex Koehne in Mitt. Deutsch. Dendr. Ges. 1904: 79. 1904, sphalm "Mearusi," *nom. subnud.* — Rydb. in N. Am. Fl. 22: 174. 1905, *descr.* — Standley in Contr. U. S. Nat. Herb. 23: 310. 1922. — Tid. & Kitt., Fl. Ariz. N. Mex. 262. 1941.



*Philadelphus mearnsii* subsp. *typicus* Hitchc. in Madroño 7: 54. 1943.

TYPE: *E. A. Mearns* 36 (US).

Spinescent low shrub, branches gray, longitudinally rimulose, calcarate; second year's growth exfoliate, the bark reddish brown; current year's growth strigose, axillary buds subglobose (FIG. 1.), strigose. Leaves oblong-lanceolate, 5–15 mm. long, 2–5 mm. wide, cuneate at the base, acute or obtuse at the apex, strigose-pilose with appressed hairs on both surfaces, the midribs indistinct on both surfaces, the lateral ones obscure, the petioles 2 mm. long. Flowers solitary in the center of a fascicle of leaves terminating a spur; pedicels 1 mm. long, strigose; hypanthium and calyx strigose-pilose, the hairs appressed, rather uniform in size, the sepals ovate-lanceolate, 3 mm. long, 2 mm. wide, the apex caudate; corolla stellate, 2 cm. across, the petals oblong-lanceolate, 8 mm. long, 2.5 mm. wide, the apex acute or rarely notched; stamens 13–16; disk and style glabrous, the style 1 mm. long, the stigmata columnar, 1.8 mm. long. Capsule hemispherical, with flat top, the radius ca. 2 mm. Seeds ecaudate.



FIG. 1. *Philadelphus mearnsii* Evans (type collection, US 19135): a. An abbreviate branchlet with a terminal flower-bud and several dormant buds axillary to falling scales ( $\times 3$ ). b. An abbreviate branchlet with a terminal flower and several lateral axillary buds ( $\times 3$ ). c. A flower with one petal removed ( $\times 5$ ).

UNITED STATES: New Mexico: Grant Co., Upper Corner Monument, *E. A. Mearns* 36, May 5, 1892 (A, photo & fragment of TYPE; F, photo of TYPE; G, ISOTYPE; US, TYPE); same locality, April 28, 1892, *Mearns* 36 (NY).

MEXICO: Central Coahuila, western side of Potrero de la Mula, *I. M. Johnston* 9238 (A).

Dr. E. A. Mearns in the Mexican Boundary Survey collected this xero-

phytic *Philadelphus*. W. E. Evans, recognizing it as a distinct species, named it and distributed it as *P. mearnsii*. Koehne got the name from Rehder through a letter. Not knowing the validity of the publication of the binomial nor the affinity of the species, he published the name in 1904 in a discussion of *P. occidentalis* Nelson, and remarked with some doubt that they might be synonymous. This became accidentally the earliest publication of *P. mearnsii* Evans. Since it was a *nomen subnudum*, it is not accepted here. In 1905 Rydberg described the species. The material he examined was labeled *Mearns 36*, from the Upper Corner Monument, Grant Co., New Mexico. It appears that specimens so labeled were collected on different dates. As the species is credited to Evans, who was in the Smithsonian Institution, the material in that herbarium should be the type. *Philadelphus mearnsii* is a very poorly known species. Among all the specimens of *Philadelphus* that I have examined, *Johnston 9238* is the only one that matches the type.

67. *Philadelphus ernestii*, sp. nov.

*Philadelphus serpyllifolius* sensu Rehder, Man. Cult. Trees Shrubs 279. 1927; ed. 2, 273. 1940; et Bibl. Cult. Trees Shrubs 194. 1949. — Sensus Hitchcock in Madroño 7: 55. 1943, pro parte, non Gray.

Frutex, ramis cinereis, bienniis brunneo-griseis strigosis, 1–1.5 mm. crassis, hornotinis strigoso-villosis, gemmis axillaribus globosis; foliis ovatis, 14–28 mm. longis, 8–13 mm. latis, basi obtusis vel rotundatis, apice obtusis mucronatisque, supra sparse pilosis, subtus villosis, pilis ad basim ± crispis, petiolo 2–3 mm. longo; floribus solitariis, pedicellis 1–1.5 mm. longis, incanis; hypanthiis et calycibus sparse villosis; sepalis ovatis, acuminatis, 4 mm. longis, 2 mm. latis, corolla disciformi, 15 mm. diametro, petalis suborbiculatis, 6–7 mm. diametro; staminibus ca. 20; disco glabro, stylo 1.5 mm. longo, glabro, stigmatibus subcapitato-columnari, 1 mm. longo; capsulis subglobosis, 4–5 mm. diametro, calycibus persistentibus circumferentibus; seminibus ecaudatis, testis brunneis, reticulatis.

UNITED STATES: Texas: Kendall Co., near Boerne, Spring Creek, *Ernest J. Palmer 11595* (A, TYPE; MO), *12900* (A), *11492* (US).

*Palmer 11492* is a mixture of two elements. The two sheets in the herbarium of the Arnold Arboretum are *P. texensis* S. Y. Hu, and the material in the herbarium of the United States National Museum apparently belongs here.

In the size and shape of the leaves *P. ernestii* resembles *P. texensis* S. Y. Hu. But these two species can be distinguished easily, for this species has villose hypanthia and capsules, and the lower leaf surfaces have only one kind of hairs, which are villose with the bases more or less curled. In *P. texensis* the hypanthia and fruit are glabrous, and the lower leaf surfaces have strigose appressed hairs mixed with a tight kinky covering of fine lanate tomentum.

The distribution of this species is limited to Kendall County of Texas,

where it grows on shaded rocky limestone bluffs. Its white flowers appear in mid-April, and its fruit matures in September. Mr. Ernest J. Palmer introduced this species into cultivation in 1917. The seed germinated and lived up to 1922 in the Arnold Arboretum under the field number 11313. It was that plant which was misinterpreted as *P. serpyllifolius* by Rehder in his Manual of Cultivated Trees and Shrubs. The type material of this species has been interpreted by Hitchcock as *P. serpyllifolius* Gray. But Gray's species has pubescent hypanthia and strigose-lanate lower leaf surfaces, while the specimens cited above are strigose only.

68. *Philadelphus bifidus*, (Hitchc.) stat. nov.

*Philadelphus mearnsii* subsp. *bifidus* Hitchc. in Madroño 7: 54. 1943.

Low shrub, the branchlets ash-gray, longitudinally rimulose; second year's growth castaneous, exfoliate, current year's growth villose, 1 mm. in diameter. Leaves ovate, 10–15 mm. long, 5–8 mm. wide, roundish or obtuse at the base, obtuse and mucronate, rarely acute at the apex, scabridously hirsute above, the hairs erect, rather densely strigose-villose beneath, the petioles 3–4 mm. long. Flowers solitary, the pedicel 1–2 mm. long, incanous; hypanthium and calyx sericeous, the sepals ovate, 5 mm. long, 3 mm. wide, acuminate; corolla cruciform, 15–22 mm. across, the petals oblong, 8–11 mm. long, 4–6 mm. wide, the apex bifid; stamens 24; disk and style glabrous, the style very short, 0.7 mm. long, the stigmata columnar, 1.75 mm. long. Capsules turbinate, 5 mm. long, 6 mm. across the top. Seed ecaudate.

MEXICO: Nuevo Leon: Sierra Madre near Monterey, C. G. Pringle 13879 (G, TYPE; US). CHIHUAHUA: H. LeSueur 635 (F, MO, US).

This species resembles *P. mearnsii* Evans ex Rydb. in having a pubescent hypanthium. But it can be distinguished readily by its ovate leaves with scabrous-hirsute upper surface, its cruciform corolla, and its larger fruit, which measure 6–7 mm. in diameter. *Philadelphus mearnsii* has oblong-lanceolate leaves with a strigose upper surface, stellate corolla, and small fruit, which measure 2–3 mm. in diameter. Available material indicates that the distribution of this species is limited to the xerophytic mountainous area of northern Mexico.

69. *Philadelphus hitchcockianus*, sp. nov.

*Philadelphus mearnsii* subsp. *typicus* Hitchcock in Madroño 7: 54. 1943, pro parte.

Frutex subspinescens, ramis cineraceis vel griseis, longitudinaliter rimulosis, bienniis cineraceis vel cineraceo-ochroleucis, hornotinis castaneis, pilosiusculis, exfoliatis, gemmis axillaribus globosis; foliis ovatis, 1–2.5 cm. longis, 6–12 mm. latis, basi obtusis, apice obtusis mucronatisque, utrinque aequabiliter brevi-strigosis, pilis appressis; petiolo ca. 2 mm. longo; floribus solitariis, pedicellis 1.5 mm. longis, strigosis; hypanthiis et



calycibus glabris; sepalis late ovatis, acuminatis, cum acumine 3 mm. longis, basi 2.5 mm. latis; corolla cruciformi, 2 cm. diametro, petalis oblongis, 8 mm. longis, 4.5 mm. latis, apice rotundatis emarginatisque; staminibus ca. 23, disco glabro, stylo 1 mm. longo, stigmatibus columnari, 1.5 mm. longo; capsulis turbinatis, 4 mm. longis, medio 5 mm. diametro, calycibus persistentibus subapicalibus; seminibus ecaudatis, testis brunneis, reticulatis.

UNITED STATES: Texas: Culberson Co., Guadalupe Mts., above McKittrick Canyon, *J. A. Moore & J. A. Steyermark 3477* (A, fr. TYPE; G, MO). New Mexico: Eddy Co., Carlsbad Cave, *Vernon Bailey*, May 5, 1924 (US, fl. TYPE).

MEXICO: Northern Coahuila, eastern side of the Sierra de los Guajes, Cañon de Milagro, *R. M. Steward 1728* (A).

The distribution of this species is limited to the semidesert region of western Texas and adjacent areas in New Mexico and northern Coahuila. There its white flowers appear in early May.

The first two specimens cited above were interpreted by Hitchcock as *P. mearnsii* ssp. *typicus*. The type material of *P. mearnsii* Evans has small oblong, lanceolate leaves 5–15 mm. long, 2–5 mm. wide, stellate corolla with oblong-lanceolate petals, and pubescent hypanthia and fruits. All the above-cited specimens have ovate leaves up to 25 mm. long, 12 mm. wide, cruciform corolla with oblong petals 4.5 mm. wide, and glabrous hypanthia and fruits. These differences are comparable to those existing between *P. lewisii* Pursh and *P. pubescens* Loisel., and I think a specific rank is justified.

#### Section 9. *Serpyllifolius*, sect. nov.

*Philadelphus* subg. IV. *Deutzioides* sect. 9. *Serpyllifolius*, sect. nov.

Frutices humiles; ramulis floriferis brevissimis; foliis parvis, integris, subtus strigosis lanatisque; floribus solitariis, flore cum foliis apice calcaris fasciculatis, pedicellis brevissimis, 1–1.5 mm. longis, hypanthiis pubescentibus vel glabris; corolla cruciformi, petalis oblongis; stylo brevissimo, stigmatibus subcapitato-columnari; fructibus turbinatis vel subglobosis; seminibus ecaudatis.

TYPE SPECIES: *Philadelphus serpyllifolius* Gray.

Species in this section are xerophytic. They are subspinescent low shrubs with very short flowering branches which appear as spurs. The trichomes on the lower leaf surfaces consist of straight strigose appressed hairs beneath which is a layer of tight kinky hairs. The styles are very short, usually only a millimeter long, and the stigmata are columnar or subcapitate clavate. The distribution of the included species is shown in map 8.

## KEY TO THE SPECIES

- A. Hypanthium villose and lanate; the upper surface of the leaves strigose with long appressed hairs and hirsute with scabridous erect ones; the persistent calyx apical on the fruit. ....70. *P. serpyllifolius*.  
 AA. Hypanthium glabrous or rarely sparsely pilose at the base; the upper surface of the leaves sparsely pilose, the hairs all appressed; the persistent calyx usually circumferential. ....71. *P. texensis*.
70. *Philadelphus serpyllifolius* Gray, Pl. Wright. 1: 77. 1852. — Walp., Ann. 4: 821. 1858. — Hemsl., Biol. Cent. Am. 1: 384. 1879. — Rydb. in N. Am. Fl. 22: 174. 1905. — Schneider, Ill. Handb. Laubh. 1: 364. 1905. — Standl. in Contr. U. S. Nat. Herb. 23: 310. 1922. — Metz, Fl. Bex. Co. Texas 112. 1934. — Tid. & Kitt., Fl. Ariz. New Mex. 262. 1941. — Hitchc. in Madroño 7: 55. 1943, pro parte.

TYPE: *C. Wright 1100* (Gray).

Subspinescent shrub up to 1.5 m. high; old branches cinereous, reticulately striate-sulcate, calcarate, second year's growth castaneous, exfoliate; bark strigose and sublanate, 1–1.5 mm. in diameter, buds conic, hirsute. Leaves entire, ovate, ovate-oblong, or ovate-lanceolate, 0.5–2 cm. long, 2–8 mm. wide, acute or obtuse at the base, obtuse, rarely rounded or acute at the apex, sparsely strigose and densely hirsute above, white with rather dense straight appressed hairs mixed with a close covering of very fine tangled tomentum, the petioles 2–4 mm. long. Flowers solitary, terminating the spurs, pedicels 1.5 mm. long, densely covered with straight white hairs, hypanthium and calyx incanous, the hairs more villose, appressed, and less lanate; sepals ovate, twice as long as the small hypanthium, 4 cm. long, 2.5 mm. wide, acuminate at the apex; corolla cruciform, 1–1.5 cm. across, the petals oblong, 4–6 mm. long, 3–4 mm. wide; stamens ca. 20, the filaments distinct; disk and style glabrous, the style 1.5 mm. long, the stigma columnar, 4-ridged, 1–1.5 mm. long. Capsules subglobose, 4 mm. in diameter, the persistent calyx apical. Seeds ecaudate, the testa brown, reticulate.

UNITED STATES: **Arizona:** Santa Rita Forest Reserve, *David Griffiths 4194* (US). **New Mexico:** *C. Wright 1100* (G, TYPE; MO, NY, US, ISOTYPES). **Texas:** Blanco Co., *B. C. Tharp*, May 9, 1951 (G); Brewster Co., Old Blue Glass Mts., *R. R. Innes & B. Moon 1231* (G), 1237 (G); same locality, *B. Warnock 559* (G); Trans-Pecos, *B. Warnock 866* p.p. (G); Culberson Co., *U. T. Waterfall 4529* (G, NY); Jeff Davis Co., *E. J. Palmer 30588a* (A), 34474 (A, F, MO, NY), 34508 (A); *V. L. Cory 9435* (A); *M. S. Young*, May 12, 1914 (MO, US); Kendall Co., *F. W. Pennell 10418* (NY); Presidio Co., *L. C. Hinckley 1763* (G, NY); without precise locality, *V. Havard 41* (G, US); *J. Reverchon 54* (G).

MEXICO: Rio Grande, below Donaña, Mexican Boundary Survey, *Parry, Bigelow, Wright & Schott 404* (NY, US); Coahuila, Monclova, Gloria Mts., *E. G. Marsh, Jr. 1903* (A, F), 1939 (A), 1940 (F).

The type of this species needs clarification, because the material that Gray designated as the nomenclatural type, *C. Wright*, n. Mexico, 1851, consists of more than one element. In the introduction of *Plantae Wrightianae* Gray mentioned that a full set of Wright's collection was retained in his own herbarium and another set was deposited in the herbarium of John A. Lowell, who patronized Wright's exploration. The material in the latter herbarium was transferred to the Gray Herbarium in 1941. In the Gray Herbarium there are now three sheets of the type material, all labeled in Gray's handwriting as *P. serpyllifolius* Gray. These three sheets are under two numbers, *C. Wright 1100* and *1101*, and each contains two or more elements. The sheet that was originally deposited in the Gray Herbarium is *Wright 1100*. I marked the two elements on it as (A) and (B). According to Gray's note *P. serpyllifolius* has leaves "three to five lines long and from one to two and a half wide," and the habit is "subspinescent." Element (A) fits this description well and therefore is the holotype of *P. serpyllifolius* Gray. Element (B) is *P. argyrocalyx* Wooton.

*Parry, Bigelow, Wright & Schott 404* in the U. S. National Herbarium has three elements. On the lower portion of the sheet there are three individual branchlets of *P. serpyllifolius*, and on the upper portion the left-hand specimen is a *Fendlera* and the right-hand one is *Philadelphus madrensis* Hemsl. In the herbarium of the New York Botanical Garden the same number has *P. serpyllifolius* on the left and *P. madrensis* on the right.

Griffith's Arizona collection was originally labeled "*Anisacanthus thurberi* (Torr.) Gray." Hitchcock named it *P. microphyllus* ssp. *argenteus* (Rydb.) Hitchc. The lower surface of the leaves of this specimen has straight appressed hairs with a layer of silvery white kinky hairs beneath. Its branchlets also have terminal buds. Both of these characters are typical of *P. serpyllifolius* Gray.

*Philadelphus serpyllifolius* is a xerophytic low shrub growing along the rock banks or on the ledges of arid canyons in the southwestern corner of Arizona, southern New Mexico, and western Texas. Its closest ally is *P. texensis* S. Y. Hu. Both species are similar in appearance and their leaves are strigose and lanate beneath. *Philadelphus serpyllifolius* has a pubescent hypanthium while in *P. texensis* it is glabrous.

#### 71. *Philadelphus texensis*, sp. nov.

Frutex ramosissimus, ramulis griseis, longitudinaliter rimulosis, bien-niis 1 mm. diametro, calcaratis, hornotinis ochraceis crispo-villosis, gemmis axillaribus conicis, apice acutis, pilosis; foliis ovatis, raro ellipticis, 0.6–3 cm. longis, 0.3–2 cm. latis, basi obtusis vel acutis, apice acutis, integerrimis, trinerviis, supra sparse pilosis, pilis appressis, subtus albo-villosis et lanatis, petiolo 5 mm. longo; floribus solitariis, apice calcarium sitis; pedicellis 1 mm. longis; hypanthiis calycibusque glabris, raro ad basim pilosis; sepalis deltoideis, apice acuminatis; corolla cruciformi, 1.5–2 mm. diametro, petalis oblongis, 7–8 mm. longis, 3 mm. latis; staminibus ca. 16,



basi filamentis dilatatis; disco et stylo glabris, stylo 1 mm. longo, indiviso, stigmatibus subcapitato-clavato; capsulis subglobosis glabris, 4 mm. diametro, calycibus persistentibus circumferentibus; seminibus ellipsoideis, 1 mm. longis, testis brunneis, reticulatis, ecaudatis.

UNITED STATES: Texas: Bexar Co., 30 miles north of San Antonio on Upper Classeus Ranch, on ledge of limestone bluff, *Ellen D. Schulz 115* (US, flower, TYPE; fragment, A); Edwards Co., Upper Cedar Creek, *E. J. Palmer 12333* (A, fruit, TYPE; MO, ISOTYPE); Kendall Co., Upper Cebelo Creek, *E. J. Palmer 11614* (A); Spring Creek near Boerne, *E. J. Palmer 11492* (A); Medina Co., Upper Hondo, *J. Reverchon 1523* (A, F, MO, US).

*Philadelphus texensis* is closely related to *P. serpyllifolius* Gray. The lower surface of the leaves of both species appears white, with straight and more or less appressed hairs beneath which is a layer of tightly kinked hairs. The corolla of both species is cruciform with oblong petals. Nevertheless the two species can be easily distinguished. In *P. serpyllifolius* the upper surface of the leaves is sparsely strigose with long appressed hairs, and uniformly densely hirsute with shorter erect ones. The calyx and hypanthium of this species are white with more straight appressed and less lanate hairs. In *P. texensis* the upper surface of the leaves is only sparsely pilose or even subglabrous with no erect hairs at all. The calyx and hypanthium of this species are definitely glabrous.

The distribution of *P. texensis* is limited to the southeastern edge of the Edward Plain of southern Texas, where it occurs on shaded limestone bluffs. Its small white flowers appear in early April.

#### 71a. *Philadelphus texensis* var. *coryanus* var. nov.

A typo hypanthiis calycibusque aequabiliter sparse pilosis differt.

UNITED STATES: Texas: Bandera Co., Vanderpool, Can Creek, *V. L. Cory 49413* (A, TYPE).

This variety differs from the typical *P. texensis* in having a pilose hypanthium and calyx, the latter being apical on the fruit. In this respect it approaches *P. serpyllifolius* Gray.

### HYBRIDS AND HORTICULTURAL VARIETIES

Within the last few decades many interspecific hybrids have been intentionally or accidentally produced and maintained in outstanding botanical gardens and nurseries. The parentage of some of them is known, but the pedigrees of most of them are unknown or uncertain. To facilitate their identification, a key to the hybrid species has been prepared, and in addition a general description of each hybrid species, with an annotated alphabetic list of the horticultural varieties included, is given. In the list the cultivar name is placed directly after the generic name. The important literature and specimens are also cited, so that the reader may

know the approximate time of the origin of each form and the history of its distribution.

The hybrids and horticultural varieties covered in this treatment are based on the material available on the grounds of the Arnold Arboretum and in that institution's herbarium of cultivated plants. There are a few very interesting forms, such as the first recorded tetrasomic diploid *P.* "Beauclerk," one of its parents, *P.* "Burfordiensis," and the triploid *P.* "Sybille," which are lacking from our collections. They are regretfully omitted here.

#### KEY TO THE HYBRID SPECIES AND ODD HORTICULTURAL FORMS

- A. Flowers white, with no black eyes at center.
- B. Hypanthium glabrous.
  - C. Tall shrubs 2–2.5 m. high; leaves large, those on the flowering shoots 3–11 cm. long, rarely smaller.
    - D. Inflorescence compact, the pedicels of the lower flowers not elongated; flowers simple, the corolla disciform, the petals sub-orbicular. ....1. *P.* × *splendens*.
    - DD. Inflorescence loose, the pedicels of the lower flowers elongated, often branched; flowers cymose.
      - E. Flowers simple, the corolla stellate, the petals elliptic, acute at the apex. ....2. *P.* × *falconeri*.
      - EE. Flowers semidouble, double or simple, the corolla disciform or cruciform, the petals oblong or obovate, rounded at the apex. ....3. *P.* × *cymosus*.
  - CC. Low shrubs 1–1.5 m. high; leaves small, those on the flowering shoots usually less than 3 cm. long.
    - D. Flowers abundant, the corolla simple cruciform or double; the petals over 1 cm. long. ....4. *P.* × *lemoinei*.
    - DD. Flowers few, the corolla campanulate, the petals less than 1 cm. long.
      - E. Leaves ovate or ovate-oblong, 1–2 cm. wide, obtuse at both ends; bark closed. ....5. *P.* "Patricia."
      - EE. Leaves ovate-lanceolate, 0.5–1 cm. wide, acute or rounded at the base, short-acuminate at the apex; bark ex-foliate. ....6. *P.* "Thelma."
  - BB. Hypanthium evidently pubescent.
    - C. Petals oblong, obovate or suborbicular, 5 or more mm. wide.
      - D. Stems nodulous; leaves glossy, pendulous, the petioles slightly twisted. ....7. *P.* × *pendulifolius*.
      - DD. Stems normal, not nodulous; leaves not pendulous.
        - E. Flowers 3 or 5, cymose or corymbose, the pedicels of the lower flowers elongated or branched.
          - F. Axillary buds enclosed. ....8. *P.* × *polyanthus*.
          - FF. Axillary buds more or less exposed. ....9. *P.* × *burkwoodii*.
        - EE. Flowers 9, 7, rarely 5 or 3, racemose, the pedicels of the lower flowers not elongated.
          - F. Flowers double or semidouble; plant 1–1.5 m. high, with stiff branches. ....10. *P.* × *virgi-alis*.

- FF. Flowers simple; plant tall for the genus, the branches usually arching.
- G. Extremely tall shrubs 4 or 5 m. high; stamens all sterile; no fruit observed. ....11. *P. × maximus*.
- GG. Moderately tall shrubs 2-3 m. high; stamens all fertile; fruiting freely.
- H. Hypanthium and sepals scabrid-villose, the hairs dense, long, and partially erect; corolla disciform, the petals suborbicular. ....12. *P. × nivalis*.
- HH. Hypanthium and sepals strigose-pilose, the hairs short and appressed; corolla subdisciform, the petals obovate. ....13. *P. × congestus*.
- HHH. Hypanthium sparsely villose, the hairs almost erect; corolla cruciform, the petals oblong.
- I. Leaves ovate; flowers 7 or 9 in loose interrupted racemes, the lower pairs of flowers in the axils of normal leaves; bark of the second year's growth gray, closed. ....14. *P. × monstrosus*.
- II. Leaves elliptic; flowers 5, 3, or 1, crowded together; bark of the second year's growth castaneous, exfoliate. ....15. *P. "Slavinii."*
- CC. Petals oblanceolate, 3 mm. wide. ....16. *P. "Stenopetala."*
- AA. Flowers white with purplish rose or pink centers.
- B. Flowers 7 in a raceme; the hypanthium and sepals glabrous. ....17. *P. "Maculiflorus."*
- BB. Flowers 3 or 1, rarely 5; the hypanthium sparsely or partially pilose.
- C. Flowers disciform or cruciform; chromosome number diploid. ....18. *P. × purpureo-maculatus*.
- CC. Flowers subcampulate; chromosome number triploid.
- D. Petals hirtellous on the inside; anthers fertile. ....19. *P. "Bicolore."*
- DD. Petals glabrous; anthers sterile. ....20. *P. "Belle étoile."*
1. *Philadelphus × splendens* Rehder in Mitt. Deutsch. Dendr. Ges. 1913 (12): 158. 1913; Man. Cult. Trees Shrubs 278. 1927, ed. 2, 273. 1940; et Bibl. Cult. Trees Shrubs 194. 1949.

An upright shrub, the bark of the second year's growth castaneous, exfoliate, the current year's growth glabrous. Leaves on the flower shoots oblong-elliptic or oblong-ovate, 6-11.5 cm. long, 2.5-5 cm. wide, the base obtuse or rounded, inconspicuously remote-denticulate or subentire, the apex shortly acuminate or acute, completely glabrous or strigose-villose on the principal nerves and in their angles. Inflorescence 5-, 7-, or 9-flowered, crowded on a rachis 1.5-3 cm. long, the lower pairs in the axils of normal leaves; hypanthium and calyx glabrous, the sepals ovate, 6 mm. long, 3-4.5 mm. wide, acuminate at the apex; corolla disciform, 3.5-4 cm. across, the petals suborbicular, 1.8 mm. long, 2 mm. wide, rounded and erose at the apex; stamens 30; disc and style glabrous; stigmata oar-shaped, the adaxial surface twice as long as the abaxial.



CULTIVATED: **America:** Arnold Arboretum 6598, *A. Rehder*, June 22, 1912 (A, TYPE); *S. Y. Hu*, June 7, 1951 (A), June 20, 1951 (A) without collector, July 2, 1917 (A); 6598-2, *E. J. Palmer*, June 16, 1916 (A); 2-333, *E. J. Palmer*, June 22, 1938 (A); Cambridge Botanical Garden, without collector, June 3, 1880 (A).

The origin of this hybrid is not known. Rehder suspected that its parents might have been *P. grandiflorus* and *P. gordonianus*. Its oblong-elliptic leaves, large disciform flowers, and oar-shaped stigmata resemble those of *P. inodorus* var. *grandiflorus* (Willd.) Gray, and its crowded racemose inflorescence resembles that of some garden forms of *P. coronarius*.

2. *Philadelphus* × *falconeri* Hort. ex Nicholson in Kew Hand-list 1: 225. 1894, ed. 2, 375. 1902, *nom. nud.* — Sarg. in Gard. For. 8: 494, fig. 68. 1895. — Möller in Deutsch. Gärtn.-Zeit. 14: 230, fig. 231. 1899. — Moore in Bailey, Stand. Cycl. Hort. 5: 2581. 1916. — Rehder, Man. Cult. Trees Shrubs 278. 1927, ed. 2, 272. 1940. — Späth, Späth-Buch 253, fig. 1930. — Bean in Chitt., Dict. Gard. 3: 1546. 1951.

Bark exfoliate. Leaves ovate or ovate-elliptic, 3–6.5 cm. long, 1–2.5 cm. wide, obtuse or rounded at the base, acuminate at the apex, sparsely strigose on the primary nerves beneath, faintly denticulate. Flowers 3, 5, up to 22 in compound cymes, the peduncle of the lower pairs elongated, 2–3.5 cm. long; hypanthium glabrous; corolla stellate, the petals elliptic, acute at the apex, uniformly hirtellous on the inside; stamens sterile; style unusually long, folded in the bud. Capsules ellipsoid, the persistent sepals circumferential; seed short-caudate, 3–9 per cent fertile.

CULTIVATED: **Europe:** Hort. Späth, *C. K. Schneider* in 1902 (A); Plantière, *C. K. Schneider*, June 26, 1906 (A). **America:** Canada: Cent. Exp. Farms, Ottawa, *G. H. M. Lawrence* 45 (BH); Dominion Bot. Gard., *G. H. M. Lawrence* 375 (BH). United States: Arnold Arboretum 538 = 2218-1 = 15345, *Falconer*, June 18, 1877 (A, TYPE); many other collections from the type plant (A); 105-38, *E. J. Palmer*, Sept. 29, 1940 (A).

Sargent received this plant from the Parsons Nursery, Flushing, N. Y. in 1881. Nothing was given about its origin. He suspected it of being a monstrous form of *P. coronarius*. Acute petals are found only in some forms of *P. lewisii*. The oblong-elliptic petals and the ellipsoid fruit with circumferential persistent calyx suggest a relationship with *P. lewisii*. The ovate-elliptic leaves and the true cymose inflorescence suggest a relationship with *P. inodorus*. The hirtellous petals show some influence of *P. mexicanus*. All these are New World species. No Old World elements possess the above-mentioned characters to contribute to *P. falconeri*. It must be New World in origin. This species has been distributed by Mrs. W. W. Gibbs, Staunton, Va., as *P. cordifolius* and by the Späth Nursery near Berlin as *P. insignis*.

3. *Philadelphus*  $\times$  *cymosus* Rehder in Jour. Arnold Arb. 1: 201. 1920; Man. Cult. Trees Shrubs 279. 1927, ed. 2, 274. 1940; et Bibl. Cult. Trees Shrubs 194. 1949.

*Philadelphus floribundus* Schrader ex DC., Prodr. 3: 205. 1852. — Moore in Bailey, Stand. Cycl. Hort. 5: 2580. 1916. — Rehder, Man. Cult. Trees Shrubs 277. 1927, ed. 2, 272. 1940; et Bibl. Cult. Trees Shrubs 194. 1949, non Roemer & Usteri, 1790.

Erect shrubs 0.5–2.5 m. high, bark brown or castaneous, exfoliate. Leaves ovate. Flowers ternate, single, or five in cyme-like crowded racemes, the pedicels of the lower pairs of the racemes elongated, sometimes branched; hypanthium glabrous; sepals leafy, ovate-lanceolate.

Rehder included some of these forms in *P. \times polyanthus*, which is characterized as having a pubescent hypanthium. They are transferred here because the hypanthium is glabrous.

- 3a. *Philadelphus* “Amalthée” Lemoine, Cat. 197: 17. 1923.

Leaves ovate-elliptic, 3–5 cm. long, 11–18 mm. wide, very sparsely strigose-pilose beneath; obtuse at the base, shortly acuminate at the apex, subentire or with 1 or 2 minute teeth on each side; corolla disciform, 3 cm. across, the base of the petals becoming pinkish at the latter part of anthesis.

CULTIVATED: Arnold Arboretum 16221, *A. Rehder*, June 28, 1927 (A).

- 3b. *Philadelphus* “Bannière” Lemoine, Cat. 164: 24. 1906. — Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

Leaves ovate, 5–7 cm. long, 2.5–4 cm. wide, rounded at the base, short-acuminate at the apex, each side 4- up to 7-serrate, glabrous and barbate in the nerve angles beneath; flowers semi-double, the anthers all sterile, some petaloid; corolla 4–4.5 cm. across, the outer petals obovate, 18 mm. long, 16 mm. wide, rounded at the apex; capsule globose; seed short-caudate, a few fertile.

CULTIVATED: Arnold Arboretum 7594 (A); Highland Park, *R. E. Hørsey*, June 4, 1918 (BH), Sept. 4, 1918 (BH).

The plant was introduced from the Lemoine Nursery before 1910. It flowered in the Arnold Arboretum in 1914.

- 3c. *Philadelphus* “Bouquet blanc” Lemoine, Cat. 155: VII. 1903, 188: 12. 1915. — Rehder, Man. Cult. Trees Shrubs 279. 1927, ed. 2, 274. 1940.

*Philadelphus* “Albâtre” Lemoine, Cat. 183: 5. 1913, 188: 12. 1915.

*Philadelphus*  $\times$  *virginalis* Rehd. “Albâtre” Rehd., Man. Cult. Trees Shrubs ed. 2, 274. 1940.

Bark grayish brown, closed; leaves small, subentire, ovate, 2–5 cm. long, 1–3 cm. wide, rounded at the base, pubescent on the nerves beneath; flowers 7 or 9, double, 2.5 cm. across, some crowded, others in a loose raceme, stamens partially fertile.

CULTIVATED: Arnold Arboretum 5089, *A. Rehder*, July 2, 1918 (A); *E. J. Palmer*, June 11, 1936 (A), June 22, 1938 (A); Arnold Arboretum 7593, *A. Rehder*, June 19, 1919 (A), June 30, 1920 (A).

Arnold Arboretum 5089 was introduced from the Lemoine Nursery in 1905, two years after the announcement of the production of this garden form. It represents a genuine *P. "Bouquet blanc."* Arnold Arboretum 7593 is labeled as *P. × virginalis* Rehd. "*Albâtre.*" This specimen probably represents the true *P. "Albâtre"* for when Lemoine announced this form he described it as a "Plant extremely floriferous, in the group of the good variety 'Virginal.'" In habit and the appearance of the double flowers, what Lemoine called *P. "Albâtre"* resembles *P. × virginalis*. But the latter hybrid is characterized by its pubescent hypanthium and *P. "Albâtre"* has glabrous ones. In the more or less closed bark, double flower and glabrous hypanthium this form is identical with *P. "Bouquet blanc."*

### 3d. *Philadelphus* "Campbell's seedling" Hort.

Leaves very small, ovate, 1.5–3 cm. long, 9–18 mm. wide, obtuse at the base, short-acuminate at the apex, sparsely pilose beneath, some variegated; flowers simple, 5 in crowded racemes or rarely one, corolla disciform, 3.5 cm. across, stamens all fertile, style divided to the disc, the stigmatic surface adaxial.

CULTIVATED: Arnold Arboretum 104–38–B, *E. J. Palmer*, June 24, 1943 (A).

This is a newly developed form. The Arnold Arboretum received its cuttings from Mrs. W. W. Gibbs, Gibbs Hill, Staunton, Va., in 1933. Nothing is known about its origin.

### 3e. *Philadelphus* "Conquête" Lemoine, Cat. 155: VIII. 1903, 188: 12. 1915. — Moore in Bailey, Stand. Cycl. Hort. 5: 2581. 1916. — Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

A low erect shrub less than 1 m. high; leaves ovate-lanceolate, 5.5–6.5 cm. long, 2–3 cm. wide, obtuse at the base, acuminate at the apex, serrate, sparsely strigose-pilose beneath; flowers 3 or 5, sometimes 7, with the lower pair cymose; corolla cruciform, 5.5 cm. across; petals obovate, the apex rounded and erose; some anthers petaloid; style divided to the base.

CULTIVATED: Arnold Arboretum 5090 (A, BH).

Rehder designated this form as the type of the hybrid *P. × cymosus*.



- 3f. *Philadelphus* "Dresden" Moore in Bailey, Stand. Cycl. Hort. 5: 2582. 1916.

Bark castaneous; leaves ovate-elliptic, 2.5–5.5 cm. long, 1.5–2.5 cm. wide, obtuse at the base, acuminate at the apex, with 6–10 sharp teeth on each side, glabrous except along the principal nerves beneath; flowers simple, ternate or solitary; corolla disciform, 3 cm. across, the petals suborbicular.

CULTIVATED: Arnold Arboretum 473–36, *E. J. Palmer*, June 7, 1938.

This plant was introduced in 1936 from H. A. Hesse, Weener-a-d-Ems, Germany. Nothing is known about its origin.

- 3g. *Philadelphus* "Gladwyne" Hort. ex Wyman, Shrubs Vines Am. Gard. 422, 1949, *nom. nud.*

Bark gray, tardily exfoliate; leaves ovate, 2.5–4 cm. long, 1–3 cm. wide, rounded or obtuse at the base, acute or short-acuminate at the apex, serrate, sparsely strigose-pilose beneath; flowers semidouble, ternate or solitary, the corolla 2.5 cm. across; style divided almost to the base.

CULTIVATED: Arnold Arboretum 292–41, *E. J. Palmer*, June 24, 1943.

This plant was introduced in 1941 from the Upper Bank Nursery, Media, Pa.

- 3h. *Philadelphus* "Mer de glace" Lemoine, Cat. 167: VIII. 1907. 170: 26, *t.* [5]. 1908. — Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

Leaves ovate, 4.5–7 cm. long, 2.8–4 cm. wide, obtuse at the base, shortly acuminate at the apex, each side with 6–15 sharp teeth, sparsely strigose-pilose beneath; flowers 3, rarely 5 or 1, semidouble, the corolla 4.5 cm. across, the outer petals obovate, the apex rounded, the style divided to the base.

CULTIVATED: Arnold Arboretum 5880–1 = 1190–24, *A. Rehder*, July 2, 1918 (A).

- 3i. *Philadelphus* "Monster" Hort.

Leaves ovate-elliptic, 5–6 cm. long, 2–2.5 cm. wide, obtuse at the base, acuminate at the apex, undulate and serrate, along the nerves villose or pilose; flowers 5, 3, or 1, not fragrant; corolla 3–3.5 cm. across; style divided almost to the base.

CULTIVATED: Arnold Arboretum, Weston Nursery, *S. Y. Hu*, June 14, 1951 (A).

- 3j. *Philadelphus* "Nuée blanche" Lemoine, Cat. 155: 23. 1903, 188: 12. 1915. — Moore in Bailey, Stand. Cycl. Hort. 5: 2581. 1916. —

Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

Leaves ovate, 2.5–5 cm. long, 1.5–2.5 cm. wide, obtuse or acute at the base, shortly acuminate at the apex, subentire or each side with 1 or 3 teeth, sparsely strigose-pilose beneath; flower solitary or ternate, semi-double, the corolla 2.5–3 cm. across, disciform.

CULTIVATED: Arnold Arboretum 5093, *G. M. Merrill*, June 6, 1922 (BH); *C. E. Kobuski* & *C. K. Allen*, June 7, 1933 (A).

This plant was introduced from Lemoine Nursery in 1905.

- 3k. *Philadelphus* "Perle blanche" Lemoine, Cat. 146: XI. 1900.— Moore in Bailey, Stand. Cycl. Hort. 5: 2581. 1916.— Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

Bark castaneous, closed, slowly wearing off; leaves ovate or elliptic, 4–8 cm. long, 1.5–3.2 cm. wide, obtuse or acute at the base, acuminate at the apex, entire, glabrous; flowers 5 or 7, the lower pairs in the axils of normal leaves, corolla cruciform, 3.5 cm. across, the petals obovate-oblong.

CULTIVATED: Arnold Arboretum 1050–36, *E. J. Palmer*, June 24, 1943 (A); *S. Y. Hu*, June 12, 1951 (A).

- 3l. *Philadelphus* "Rosace" Lemoine, Cat. 158: VIII. 1904, 188: 12. 1915.— Moore in Bailey, Stand. Cycl. Hort. 5: 2581. 1916.— Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

Bark castaneous, closed, slowly wearing off; leaves elongate-ovate, 6.5–10 cm. long, 2.5–5 cm. wide, obtuse at the base, acuminate at the apex, sparsely pubescent beneath; flowers large, 5 in a true cyme or 3, the corolla 5 cm. across, the petals obovate, 2.5 cm. long, 2.5 cm. wide, the style divided to the base.

CULTIVATED: Arnold Arboretum 5095 (A); Highland Park, *R. E. Horsey*, June 11, 1918 (BH).

This plant shows strongly the influence of *P. inodorus*.

- 3m. *Philadelphus* "Velleda" Lemoine, Cat. 169: 17. 1923.

Bark exfoliate; leaves small, ovate, 1.5–3 cm. long, 8–15 mm. wide, subentire or each side with 2–4 coarse teeth; flowers solitary, the corolla disciform, 2.5 cm. across, the petals suborbicular.

CULTIVATED: Arnold Arboretum 19269, *E. J. Palmer*, June 11, 1936 (A).

This plant was introduced from the Lemoine Nursery in 1925. It shows strongly the influence of *P. inodorus*.

- 3n. *Philadelphus* "Undulatus" Petzold & Kirchner, Arb. Muscav. 205. 1864. — Koch, Dendrol. 341. 1869. — Nicholson, Kew Hand-list 1: 227. 1894, ed. 2, 377. 1902.

Bark castaneous, exfoliate; leaves ovate-elliptic, serrate, sparsely pilose beneath; flowers semidouble.

CULTIVATED: Hort. Leipzig, C. K. Schneider, June 26, 1901 (A).

This plant shows the influence of *P. inodorus* strongly. It is probable that it no longer exists in cultivation.

- 3o. *Philadelphus* "Umbellatus" Koehne, Deutsche Dendr. 183. 1893.

*Philadelphus zeyheri* var. *umbellatus* (Koehne) Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 277. 1927, ed. 2, 272. 1940.

A low shrub, 1 m. high, the bark castaneous, exfoliate, the current year's growth glabrous; leaves ovate-elliptic, 6–9 cm. long, 1.5–6.5 cm. wide, obtuse at the base, acuminate at the apex, prominently denticulate, rarely subentire, sparsely pilose on both surfaces or glabrescent above; flowers 10 up to 15 in loose panicles, rarely fewer in depauperate racemes, the hypanthium and sepals glabrous; corolla disciform, 2.5–4 cm. across, the petals obovate or suborbicular, 1.2–1.8 cm. in diameter, rounded at the apex; stamens all sterile; style longer than the stamens, glabrous; capsules ellipsoid, 8 mm. long, 6 mm. in diameter.

CULTIVATED: Europe: Hort. Göttingen, A. Rehder 384 (A), 402 (A), 1671 (A), July 1, 1890 (A). United States: Arnold Arboretum 3855, A. Rehder, July 18, 1918 (A), June 19, 1919 (A); S. Y. Hu, June 7, 1951 (A); Bot. Gard. Cambridge, A. Rehder, June 7, 1918 (A); Glenn Dale Introduction Garden PI59426, W. H. Cowgill 688 (BH).

This horticultural form has been cultivated in German gardens since the 1890's. Its origin is not known. The pilose leaves, exfoliate bark, disciform corolla, and elongated style suggest some relationship with the *P. inodorus* complex. The Arnold Arboretum obtained its plant from the Späth Nursery in 1908. It produces few flowers. The field note of Cowgill 688 gives the origin of that specimen as Yunnan, China. But the specimen bears no character of the *Philadelphus* known to Yunnan. There may be a mistake in the labeling of the plant.

4. *Philadelphus* × *lemoniei* Lemoine Cat. ? 1887, 109: 24. 1888. — Anon. in Wien. Ill. Garten-Zeit 1888: 124. 1888. — Sargent in Gard. For. 2: 616, fig. 154. 1889. — Koehne in Gartenfl. 45: 507. 1896. — Darnell in Hardy Plants 1: 197. 1930. — Rehder, Man. Cult. Trees Shrubs 279. 1927, ed. 2, 273. 1940. — Späth, Späth-Buch 254, fig. 255. 1930. — Bean in Chitt., Dict. Gard. 3: 1546. 1951.

A compact low shrub, spreading as wide as the height of the plant; bark exfoliate; leaves ovate, 1.5–2.5 cm. long, 7–12 mm. wide, glabrous



above, sparsely strigose beneath, rounded or obtuse at the base, short-acuminate at the apex, with 2 or 3 teeth on each side; flowers ternate or solitary, rarely 5, the hypanthium glabrous, the sepals ovate, 4 mm. long; corolla cruciform, 2.5–3 cm. across, the petals ovate, erose at the apex; style 3 mm. long, divided almost to the base, stigmata 2.5 mm. long, clavate.

CULTIVATED: **Europe:** Bot. Gart. Forstakademie 44, *H. Zabel*, June 20, 1894 (A); Plantière, *C. K. Schneider*, Sept. 1903 (A); Hort. Bot. Wien, *C. K. Schneider*, June 21, 1902 (A). **United States:** Arnold Arboretum 1830, without collector, June 30, 1890 (A); 3449, without collector, June 27, 1904 (A); 1830–B, *E. J. Palmer*, June 22, 1938 (A); Glenn Dale Introduction Garden, Maryland, *P. I.* 52455, *W. H. Cowgill* 714 (A, BH).

In 1884 Lemoine produced this hybrid by applying the pollen of a garden form of *P. coronarius* to *P. microphyllus*. The seedling flowered when less than three years old. In 1888 it was introduced into the Arnold Arboretum. The plants numbered *P. I.* 52455 are distributed as *P. tenuifolius* or *Deutzia* sp.

- 4a. *Philadelphus* "Avalanche" Lemoine, Cat. 132: 5. 1896. — Möller's Deutsche Gärtner-Zeit. 22: 379, fig. 1907. — Gard. Chron. III. 21: 89, fig. 25. 1897. — Rehder, Man. Cult. Trees Shrubs 279. 1927, ed. 2, 273. 1940.

An erect shrub up to 2 m. high, bark gray, closed; leaves elliptic, 2–2.5 cm. long, 5–8 mm. wide, acute at both ends, both sides glabrous, entire; flowers 7, rarely 5 or 9; corolla cruciform, 2–2.5 cm. across, the petals obovate-oblong, 10 mm. long, 8 mm. wide, rounded at the apex.

CULTIVATED: Arnold Arboretum 4154, without collector, June 22, 1903 (A), June 29, 1906 (A).

This form shows the influence of *P. lewisii*.

- 4b. *Philadelphus* "Bonje" Hort.

Bark slowly wearing off; leaves very small, ovate-elliptic, those on the flowering shoot 9–14 mm. long, 4–5 mm. wide, obtuse at the base, acute at the apex, entire, sparsely pilose on the nerves beneath; flowers solitary, ternate, or very rarely five, the corolla semidouble, 1.5 cm. across.

CULTIVATED: Arnold Arboretum 734–36, *E. J. Palmer*, June 22, 1938 (A).

This form was distributed by the John Siebenthaler Nurseries, Dayton, Ohio. Nothing is known about its origin.

- 4c. *Philadelphus* "Candélabre" Lemoine, Cat. 127: 24. 1894. — Reh-

der in Möller's Deutsch. Gärtn.-Zeit. 11: 294. 1896; et Man. Cult. Trees Shrubs 279. 1927, ed. 2, 273. 1940.

Bark castaneous, closed, tardily exfoliate; leaves ovate, 1.5–2.3 cm. long, 6–11 mm. wide, rounded at the base, acuminate at the apex, entire, villose on the nerves beneath; flowers solitary, rarely ternate, the corolla almost cup-shaped, 3.5 cm. across becoming cruciform, the petals ovate, obtuse at the apex, erose, 13 mm. long, 11 mm. wide.

CULTIVATED: Arnold Arboretum 4151, without collector, June 27, 1904 (A), June 25, 1909 (A).

This is one of the most beautiful garden forms. Its large flowers resemble those of *P. "Bicolore"* but do not have the purplish center. It was produced by the Lemoine Nursery in 1894 and introduced into the Arnold Arboretum before 1904.

4d. *Philadelphus* "Coupe d'argent" Lemoine, Cat. 189: 20. 1915. — Anon. in Gard. 86: 332, fig. 1922, 87: 116, fig. 1923.

Bark castaneous, exfoliate; leaves ovate, 2.5–4 cm. long, 1–1.5 cm. wide, rounded at the base, acute or shortly acuminate at the apex, minutely serrate, with 2–4 teeth on each side, sparsely pilose on the primary nerves beneath; flowers ternate, rarely 5 with the lower pair in the axils of normal leaves; corolla disciform, 3 cm. across, the petals orbicular, 1.5 cm. in diameter.

CULTIVATED: Arnold Arboretum 19260, *E. J. Palmer*, June 10, 1937 (A); *S. Y. Hu*, June 13, 1951 (A); 400–36, *E. J. Palmer*, June 20, 1938 (A).

This form was introduced from the Lemoine Nursery in 1925. Its leaves resemble *P. × lemoinei*, from which it can be distinguished by its disciform flowers. It shows strongly the influence of *P. inodorus*.

4e. *Philadelphus* "Dame blanche" Lemoine, Cat. 177: 7. 1911, 188: 12. 1915.

A very small, delicate shrub, the bark nigrescent, closed, tardily wearing off; leaves ovate, 1.5–2 cm. long, 7–8 mm. wide, obtuse or rounded at the base, acute at the apex, sparsely strigose on the primary nerves beneath; flowers 5, rarely 3, the sepals ovate, acuminate, the corolla disciform, 14–18 mm. across, the petals obovate, 8 mm. long.

CULTIVATED: Arnold Arboretum 21990, *E. J. Palmer*, June 18, 1936 (A).

This form was introduced into the Arnold Arboretum in 1926 in the form of cuttings from the Späth Nursery. It shows the influence of *P. lewisii* strongly.

4f. *Philadelphus* "Erectus" Lemoine, Cat. 121: 23. 1892. — Rehder in Möller's Deutsche Gärtner-Zeit. 11: 294. 1896; et Man. Cult. Trees

Shrubs ed. 2. 274. 1940. — Hasach in Möller's *Deutsche Gärtner-Zeit.* 17: 383. fig. 1902.

A very low shrub, the bark grayish or nigrescent, closed and tardily wearing off; leaves elongate-ovate to sublancoate, 1.5–4.5 cm. long, 8–18 mm. wide, obtuse or rounded at the base, gradually elongate and acute or acuminate at the apex, serrate, with 1 or 3 teeth on the apical end of each side, at the basal end sparsely and partially pilose; flowers ternate, rarely 5 with the lower pair in the axils of normal leaves, the sepals ovate, long-acuminate, the corolla cruciform, the petals oblong.

CULTIVATED: **Europe:** Bot. Gart. Forstakademie 46, *H. Zabel*, June 20, 1894 (A); *Plantière, C. K. Schneider*, June 26, 1906 (A). **United States:** Arnold Arboretum 4152, without collector, June 29, 1909 (A); 19–36, *E. J. Palmer*, June 24, 1943 (A), Sept. 20, 1940 (A).

This form was developed by the Lemoine Nursery in 1890. It shows strongly the influence of *P. inodorus* var. *laxus*.

4g. *Philadelphus* "Innocence" Lemoine, Cat. 201: 18. 1928.

Leaves small, ovate-lanceolate, those on the flowering shoot 2.5–3.5 cm. long, 7–15 mm. wide, acute at both ends, strigose-pilose on the nerves beneath; flowers 5 or 7, crowded on short branches, the corolla 3–3.5 cm. across, disciform, the style divided almost to the base.

CULTIVATED: Arnold Arboretum 21882 = 288–32, *E. J. Palmer*, Aug. 18, 1936 (A), June 24, 1943 (A).

4h. *Philadelphus* "Manteau d'hermine" Lemoine, Cat. 140: IX. 1898, 188: 12. 1915. — Rehder, *Man. Cult. Trees Shrubs* 279. 1927; ed. 2, 274. 1940.

A depauperate low shrub, the bark grayish brown, closed; leaves yellowish green, small, ovate-elliptic, rarely ovate, 7–25 mm. long, 4–12 mm. wide, acute at both ends, pilose on the nerves beneath; flowers inodorous, double, the bud pinkish, the corolla 2.3–3 cm. across, the outer petals oblong.

CULTIVATED: **Europe:** Hort. *Plantière, C. K. Schneider*, June 26, 1926 (A). **United States:** Arnold Arboretum 4156, without collector, June 20, 1901 (A), June 25, 1909 (A); *S. Y. Hu*, June 14, 1951 (A).

This form was produced by the Lemoine Nursery in the 1890's. Its pink flower bud shows the influence of *P. pekinensis* to some extent.

5. *Philadelphus* "Patricia" Hort. ex Wyman, *Shrubs Vines Am. Gard.* 422. 1949.

A low, erect, tufted shrub 1 m. high; bark of the second year's growth gray, closed, the current year's growth hirtellous; the buds enclosed. Leaves ovate or ovate-oblong, 2–4 cm. long, 1–2 cm. wide, obtuse at both



ends or acute at the apex, entire or faintly sinuate-denticulate, with 1 or 2 teeth on each side, sparsely hirsute on both surfaces. Flowers 3 or 5; the hypanthium glabrous or with a few hairs at the base; sepals ovate, 3–4 mm. long; corolla cup-shaped, the petals obovate, 10 mm. long, 6–7 mm. wide; stamens ca. 15 fertile, or poorly developed and sterile; disc and style glabrous.

CULTIVATED: Arnold Arboretum 605–39, *E. J. Palmer*, June 24, 1943 (A), *S. Y. Hu*, June 13, 1951 (A).

This interesting little plant produces few flowers. Its dark green foliage and upright habit give it a very characteristic appearance, which is different from any other *Philadelphus* in the Arnold Arboretum collection. It reminds one of *P. lewisii* var. *intermedius*. It is planted at the lower end of the Weston Nursery of the Arboretum. It may be that the poorly drained soil in which it grows has altered its normal behavior. The plant was obtained in 1939 from F. L. Skinner, Dropmore, Manitoba, Canada. Nothing is known of its origin.

#### 6. *Philadelphus* "Thelma" Hort.

A graceful little shrub, the bark castaneous, exfoliate; leaves ovate-lanceolate, 2–2.5 cm. long, 5–10 mm. wide, acute or rounded at the base, acute or shortly acuminate at the apex, sparsely strigose beneath, entire or faintly serrate, each side with 2 or 3 small sharp teeth; flowers ternate, rarely 5; corolla campanulate, 1.5 cm. across, the petals obovate, 9 mm. long.

CULTIVATED: Arnold Arboretum 606–39, *E. J. Palmer*, June 24, 1943 (A).

This form was distributed by F. L. Skinner, Dropmore, Manitoba, Canada, in 1939. Nothing is known about its origin. It shows the influence of *P. purpurascens*.

7. *Philadelphus* × *pendulifolius* Carr. in Rev. Hort. 1875: 360. 1875. — Koehne in Gartenfl. 45: 542. 1896. — Schneider, Ill. Handb. Laubh. 1: 369. 1905. — Rehder, Man. Cult. Trees Shrubs 273. 1927, ed. 2, 267. 1940.

*Philadelphus verrucosus* var. *pendulifolius* Moore in Bailey, Stand. Cycl. Hort. 5: 2581. 1916.

*Philadelphus latifolius pendulifolius* Schnelle ex Beissner et al., Handb. Laubh. 127. 1903. — Starcs. in Darzkobibas Rokstu 1: 122. 1925.

An upright shrub about 2 m. high, the branches erect, ramified and nodulous, the second year's growth castaneous, closed, the current year's growth glabrous or glabrescent. Leaves glossy, pendulous, ovate or broad-elliptic, 5–11 cm. long, 3–7 cm. wide, obtuse or rounded at the base, acuminate at the apex, subentire or faintly serrate, glabrous above, uniformly strigose-pilose beneath. Flowers 5 or 7, the lower pairs in the axils of

normal leaves; hypanthium and calyx densely strigose-villose, the hairs erect; sepals ovate, 5 mm. long; corolla cup-shaped, 2.5–2.8 cm. across, the petals obovate, 1.2 cm. long; stamens sterile, the disc glabrous, the style equal to or longer than the stamens, the apical end twisted in the bud. Capsules turbinate, the persistent sepals supermedian. Seeds long-caudate.

CULTIVATED: **Europe:** Hort. Plantière. *C. K. Schneider*, Sept. 1903 (A); Hort. Späth, *C. K. Schneider*, in 1902 (A). **United States:** Arnold Arboretum 5315, without collector, Sept. 10, 1913 (A); *A. Rehder*, July 5, 1917 (A); *G. M. Merrill*, June 22, 1923 (BH); *S. Y. Hu*, June 12, 1951 (A); 5311, *E. J. Palmer*, June 11, 1936 (A); Highland Park, *R. E. Horsey*, Oct. 2, 1917 (BH).

This noteworthy hybrid was raised from the seed collected by Billiard from a *Philadelphus* called "Fontenea-aux-roses." Koehne interpreted it as a hybrid of *P. pubescens* and *P. laxus*. Rehder doubtfully accepted this assumption. It is closely related to *P. pubescens*. As to the other parent, I think the influence of *P. inodorus* var. *carolinus* is very evident. The nodulous stems give one the impression of some insect or fungus infection. It is a very rare specimen. The Arnold Arboretum obtained this plant from the Späth Nursery in 1906.

8. *Philadelphus* × *polyanthus* Rehder in Jour. Arnold Arb. 1: 201. 1920; Man. Cult. Trees Shrubs 279. 1927, ed. 2, 274. 1940; et Bibl. Cult. Trees Shrubs 194. 1949.

An erect shrub, the bark castaneous, closed, tardily exfoliate, the current year's growth sparsely villose; leaves ovate, 3.5–5 cm. long, 1.5–2.5 cm. wide, rounded or obtuse at the base, acuminate at the apex, entire or with 1–3 sharp teeth on each side, glabrous above, sparsely strigose-pilose beneath; flowers 3 or 5, cymose or corymbose, the pedicels of the lower flowers elongated, sometimes branched; hypanthium and sepals uniformly pubescent, the sepals ovate, caudate at the apex, 5–8 mm. long; corolla cruciform, 3 cm. across, the petals oblong, 1.5 cm. long, 1 cm. wide.

CULTIVATED: **Europe:** Hort. Plantière, *C. K. Schneider*, June 26, 1906 (A). **United States:** Arnold Arboretum 4158, without collector, June 22, 1903 (A); *S. Y. Hu*, June 1951 (A).

Rehder designated "Gerbe de neige" as the type form of this hybrid. The plant in the Arnold Arboretum was introduced from the Lemoine Nursery in 1900.

The following forms all have pubescent hypanthia. They should be placed here: "Atlas," "Boule d'argent," "Favorite," "Mont Blanc," "Norma," "Pavillon blanc," and "Van Houttei."

- 8a. *Philadelphus* "Atlas" Lemoine, Cat. 197: 17. 1923.

Bark castaneous, opaque, closed, with transverse cracks; the current year's growth glabrous; leaves ovate, (3–) 6–9 cm. long, 3–6 cm. wide,

obtuse at the base, shortly acuminate at the apex, glabrous above, uniformly strigose-pilose beneath; flowers 5 or 7, racemose, the hypanthium and sepals sparsely strigose-villose; sepals ovate, 5–6 mm. long; corolla cruciform, 3.5 cm. across, the petals oblong, 1.5 cm. long, 9–10 mm. wide; stamens fertile; disc and style glabrous.

CULTIVATED: Arnold Arboretum 21387, *E. J. Palmer*, June 11, 1936 (A).

The Arnold Arboretum got this plant from the Morton Arboretum, Lisle, Ill. In the size of the flowers, the indumentum of the hypanthium, and the shape of the corolla, this form resembles *P. "Gerbe de neige."* It can be distinguished from the latter by its racemose inflorescence. The flowers of *P. "Gerbe de neige"* are three in a cyme or five in a corymb. Arnold Arboretum 19539 labeled *P. "Atlas"* is *P. floridus*. The flowers of that specimen are disciform.

8b. *Philadelphus* "Boule d'argent" Lemoine, Cat. 125: 11. 1893.—Rehder, Man. Cult. Trees Shrubs 279. 1927, ed. 2, 273. 1940.

Bark castaneous, tardily exfoliate, the current year's growth sparsely villose, glabrescent; leaves ovate, 3–4.5 cm. long, 1.5–2 cm. wide, rounded at the base, acute at the apex, glabrous above, very sparsely pilose on the primary nerves beneath; flowers double, 3 or 5, cymose, the pedicels of the lateral flowers 3–5 times longer than that of the center one, the hypanthium sparsely pilose; sepals glabrous, ovate, acuminate, 5–6 mm. long; corolla double, 3.5 mm. across.

CULTIVATED: Europe: Hort. Plantière, *C. K. Schneider*, June 26, 1906 (A). United States: Arnold Arboretum 4155, without collector, June 21, 1916 (A).

The flower of this form reminds one of that of *P. coronarius* var. *dianthiflorus*, but it can be distinguished from the latter by its ternate or cymose flowers.

8c. *Philadelphus* "Favorite" Hort. ex Rehder, Man. Cult. Trees Shrubs 279. 1927, ed. 2, 274. 1940.

Bark gray or brown, closed or tardily exfoliate, the current year's growth sparsely villose; leaves ovate, 1.5–3 cm. long, 0.5–2 cm. wide, glabrous above, rounded or obtuse at the base, acute or shortly acuminate at the apex, uniformly strigose-pilose beneath; flowers 3 or 5, crowded, the hypanthium and sepals strigose-pilose; corolla cruciform, 3.5 cm. across, the petals obovate-oblong, 1.2 cm. long, 1 cm. wide; stamens all fertile; disc and style glabrous; capsules ellipsoid; seeds long-caudate.

CULTIVATED: Arnold Arboretum 8093, *A. Rehder*, June 23, 1919 (A); 449–41, *E. J. Palmer*, June 24, 1943 (A); Highland Park, *Mrs. R. E. Horsey*, June 16, 1918 (BH), Sept. 4, 1918 (BH).

The plants in the Arnold Arboretum are from two sources. Arnold Arboretum 8093 was from the Rochester Park Department, and no. 449–41 was from the H. Kohankie Nursery, Painesville, Ohio.

This form shows strongly the influence of *P. pubescens* Loisel. Its origin is not known.

- 8d. *Philadelphus* "Mont Blanc" Lemoine, Cat. 134: 5. 1896, 188: 12. 1915. — Rehder, Man. Cult. Trees Shrubs 279. 1927, ed. 2, 274. 1940.

Bark castaneous, closed, tardily exfoliate, the current year's growth strigose-pilose, the hairs with thickened bases; leaves ovate, 1.8–3 cm. long, 8–18 mm. wide, entire or with 1 or 3 teeth on the middle of each side, glabrous above, very sparsely and partially pilose beneath; flowers 3, 5, rarely 1, the hypanthium strigose-pilose; sepals glabrous; corolla cruciform, 2.5 cm. across, the petals obovate-oblong, 11 mm. long, 8 mm. wide; stamens fertile; disc and style glabrous.

CULTIVATED: Arnold Arboretum 4157, A. Rehder, July 2, 1918 (A).

Rehder placed this form in *P. × lemoinei*. Its pubescent hypanthium suggests a closer relationship with *P. × polyanthus*.

- 8e. *Philadelphus* "Norma" Lemoine, Cat. 173: 33. 1909, 188: 12. 1915. — Rehder in Jour. Arnold Arb. 1: 202. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

Bark grayish brown, closed, tardily wearing off, the current year's growth strigose-pilose; leaves ovate, 3–5 cm. long, 1.2–3 cm. wide, rounded or obtuse at the base, acuminate at the apex, glabrous above, partially pilose beneath, serrate; flowers 5, rarely 3, the hypanthium and sepals sparsely villose; sepals ovate, caudate, 9 mm. long; corolla disciform, semidouble, 4–4.5 cm. across, the petals suborbicular, 14–18 mm. in diameter; stamens fertile; disc and style glabrous.

CULTIVATED: Arnold Arboretum 7595, without collector, July 2, 1917 (A); G. M. Merrill, June 22, 1923 (BH); 930–29, E. J. Palmer, June 11, 1936 (A); 19265, E. J. Palmer, June 11, 1936 (A), E. R. Sears, June 21, 1935 (BH), Sept. 13, 1935 (BH); Highland Park, R. E. Horsey, June 16, 1918 (BH), Sept. 4, 1918 (BH).

Rehder placed this form under *P. × cymosus* in his manual. The type form of that hybrid has a glabrous hypanthium. As *P. "Norma"* has a pubescent hypanthium, it is better to place it under *P. × polyanthus*, which is characterized by a pubescent hypanthium.

This form was introduced on two occasions from the Lemoine Nursery, once in 1913 and the second time in 1925. The first introduction carries the field number 7595 and the second 19265. Arnold Arboretum 930–29 was made from a cutting of 7595. The disciform flower and the indumentum on the hypanthium of these plants remind one of *P. floridus* Beadle.

- 8f. *Philadelphus* "Pavillon blanc" Lemoine, Cat. 134: 5. 1896, 148: 33. 1901. — Rehder in Jour. Arnold Arb. 1: 201. 1920; et Man. Cult. Trees Shrubs 279. 1927, ed. 2, 274. 1940.



Bark castaneous, closed, tardily wearing off, the current year's growth strigose-pilose; leaves ovate, 1.7–3.5 cm. long, 1–1.8 cm. wide, entire, obtuse at the base, acute at the apex, glabrous above, uniformly strigose-pilose beneath; flowers 5, 7, or 3, the hypanthium and sepals uniformly strigose-villose; corolla cruciform, 3.5–4 cm. across, the petals oblong, 17 mm. long, 11 mm. wide, erose at the apex; stamens largely sterile, the anthers mucronate at the apex; disc and style glabrous.

CULTIVATED: Arnold Arboretum 4153, without collector, June 27, 1904 (A), June 29, 1906 (A); *S. Y. Hu*, June 22, 1951 (A).

This form was introduced to the Arnold Arboretum in 1900. The plant, numbered 4153, flowered in 1904. It is a low mound-shaped shrub. The flowers are fragrant.

8g. *Philadelphus* "Van Houttei" Hort. ex Bean in Kew, Hand-list ed. 4, 199. 1934, *nom. nud.*

Bark nigrescent, closed; the current year's growth sparsely scabrous-villose, glabrescent; leaves oblong-ovate, 5–7 cm. long, 2.5–3 cm. wide, obtuse at the base, acuminate at the apex, partially hirsute and becoming glabrescent above, rather densely and uniformly scabrous-villose beneath; flowers 3 or 9, the lower pair in the axils of normal leaves, cymose, the peduncles 11–22 mm. long; hypanthium and sepals incanously strigose-pilose, the hairs appressed; sepals foliaceous, ovate, caudate, 8–16 mm. long; corolla disciform, 3.5 cm. across, the petals ovate-orbicular, 1.5 cm. long, 1.4 cm. wide; stamens fertile; disc and style glabrous.

CULTIVATED: Arnold Arboretum 19572, *E. J. Palmer*, June 11, 1939 (A).

The Arnold Arboretum obtained this plant from Kew in 1925. Nothing is known about its parentage. It shows strongly the influence of *P. pubescens* Loisel. and *P. floridus* Beadle.

9. *Philadelphus* × *burkwoodii* Hort. ex Gard. Chron. III. 89: 438. 1931.

Bark nigrescent, closed, slowly exfoliate, the current year's growth strigose-pilose, the hairs with thickened bases, the axillary buds exposed. Leaves ovate or ovate-elliptic, those on the vegetative branches 3.5–6.5 cm. long, 1.5–3 cm. wide, those on the flowering branches 1.5–3.5 cm. long, 0.6–1.5 cm. wide, obtuse at the base, acute or shortly acuminate at the apex, glabrous above, sparsely strigose-pilose beneath. Flowers 1, 3, or rarely 5, the sepals and hypanthium sparsely, sometimes partially pilose, the hairs appressed; sepals ovate, caudate, 8–15 mm. long; corolla cruciform, 4.5 cm. across, the petals obovate-oblong, 2.1 cm. long, 1.2 cm. wide, sparsely pilose on the inside; stamens fertile; disc and style glabrous, divided almost to the base, the stigmata clavate. Capsule ellipsoid, pointed at both ends, the persistent sepals circumferential.

CULTIVATED: **Europe:** Kew 109.30 (Burkwood), *R. Melville*, June 22, 1937 (A), Sept. 10, 1937 (A). **United States:** Arnold Arboretum 864-34, *E. J. Palmer*, Sept. 1, 1939 (A), July 9, 1940 (A).

As recorded in *Gardener's Chronicle*, this cultivar was a product of a cross between *P. "Étoile rose"* and *P. "Virginal."* Its exposed axillary buds and its pubescent petals suggest a relationship with *P. mexicanus*. The plant in the Arnold Arboretum was raised from a cutting obtained from Mrs. J. Norman Henry, Gladwyne, Penn. The inside of the petals of that plant is not hirtellous.

10. *Philadelphus*  $\times$  *virginalis* Rehder in *Jour. Arnold Arb.* 1: 202. 1920; et *Man. Cult. Trees Shrubs* 280. 1927, ed. 2, 274. 1940.

Erect shrubs of medium height, 1-2.5 m. high, the branches stiff, upright, the bark of the second year's growth gray, closed, tardily wearing off, the current year's growth sparsely villose, glabrescent. Leaves ovate, 4-7 cm. long, 2.5-4.5 cm. wide, rounded at the base, shortly acuminate at the apex, glabrous or glabrescent above, uniformly strigose-villose beneath. Inflorescence racemose, the lower pairs in the axils of normal leaves, rarely ternate; hypanthium and sepals uniformly strigose-villose or incanous, the flowers double. Capsules subglobose or ellipsoid. Seed when present medium caudate, the testa brown.

This hybrid was typified by the cultivar *P. "Virginal."* It is characterized by the rather large ovate villose leaves, the double racemose flowers, and the pubescent hypanthium and calyx. It should also include the following forms: "*Argentine*," "*Boule d'argent*," "*Enchantment*," "*Fleur de neige*," "*Glacier*," "*Le Roi*," and "*Pyramidal*." They show the influence of *P. pubescens* Loisel. so much that they may be regarded as the double-flowered garden forms of that species.

- 10a. *Philadelphus* "*Argentine*" Lemoine, *Cat.* 185: 5. 1913, 188: 12. 1915. — Rehder, *Man. Cult. Trees Shrubs* 280. 1927, ed. 2, 274. 1940.

Bark gray, closed, the current year's growth glabrous; leaves broad-ovate, 3-4.5 cm. long, 1.5-3 cm. wide, subentire or with 2, 3, or 4 teeth on each side, rounded at the base; flowers ternate, rarely 5 or 1; corolla 4-4.5 cm. across, the petals numerous, about 30, rounded or obtuse at the apex.

CULTIVATED: Arnold Arboretum 7074, without collector, June 26, 1916 (A); 7074-1, *E. J. Palmer*, June 18, 1936 (A); 203-38, *E. J. Palmer*, Sept. 19, 1940 (A); *S. Y. Hu*, June 15, 1951 (A).

Arnold Arboretum 7074 was introduced directly from the Lemoine Nursery. It is a genuine form. Arnold Arboretum 203-38 was from Wilhelm Pfitzer, Stuttgart, Germany.

10b. *Philadelphus* "Enchantment" Lemoine, Cat. 197: 18. 1923.

Bark nigrescent, closed, the current year's growth villose; leaves ovate, 3–5 cm. long, 1.2–3 cm. wide, obtuse or rounded at the base, acute or shortly acuminate at the apex, serrate; flowers 7 or 9, the corolla 2.5 cm. across, the outer petals rounded and the inner ones acute.

CULTIVATED: Arnold Arboretum 19534, *E. J. Palmer*, June 11, 1936 (A); 21996, *E. J. Palmer*, June 11, 1936 (A); 21881, *E. J. Palmer*, June 23, 1938 (A).

The first cited specimen was introduced in 1925 from the Chenault Nursery, Orléans, France. The last was obtained from the Lemoine Nursery in 1932.

10c. *Philadelphus* "Fleur de neige" Lemoine, Cat. 189: 20, *t.* [2]. 1915.

Lemoine described this form as having "the appearance of *P. inodorus* var. *grandiflorus* with large semidouble flowers covering the whole shrub with a mantle of snow." The plant in the Arnold Arboretum bearing this name was obtained as cuttings from the Park Department, Rochester, N. Y. It has simple flowers and does not match Lemoine's illustration. It does not represent the genuine "Fleur de neige."

10d. *Philadelphus* "Glacier" Lemoine, Cat. 185: 5. 1913, 188: 12. 1915.

Bark gray, closed; the current year's growth glabrous; leaves generally small, 2.5–3.5 cm. long, 1.2–2.5 cm. wide, rounded or subcordate at the base, obtuse or acute at the apex, serrate; flowers fragrant, 7, 9, or 5, the corolla 2.5 cm. across, the petals obtuse or acute at the apex.

CULTIVATED: Arnold Arboretum 7075, without collector, July 2, 1917 (A); 7075–2, *E. J. Palmer*, June 11, 1938 (A); 19263, *E. J. Palmer*, June 11, 1936 (A).

This entity flowers late. Its fragrant flowers last for a long time on the plant. It is a very desirable form for small gardens. All the Arnold Arboretum plants were introduced from the Lemoine Nursery. They are true to the type.

10e. *Philadelphus* "Girandole" Lemoine, Cat. 189: 20, *t.* [3]. 1915. —  
Silva Tarouca, Freil.-Laubgeh. 257, *fig.* 307. 1930.

Bark castaneous, exfoliate, the current year's growth pilose; leaves ovate, 2.5–4.5 cm. long, 1.3–2.3 cm. wide, subentire or with 1–6 teeth on each side, rounded at the base, acute or shortly acuminate at the apex, uniformly pilose on both surfaces; flowers 5 or 7, racemose, the hypanthium and sepals sparsely pilose; sepals long-caudate, 7–10 mm. long; corolla double, 3.5 cm. across; petals rounded at the apex; stamens all sterile.

CULTIVATED: Arnold Arboretum 19262, *E. J. Palmer*, June 11, 1936 (A), *S. Y. Hu*, June 8, 1951 (A).

This plant was introduced into the Arnold Arboretum in 1925. It came from the Lemoine Nursery, Nancy, France.

10f. *Philadelphus* "Le Roi" Hort.

A very low shrub up to 1 m. high, the bark nigrescent, closed, tardily wearing off, the current year's growth glabrous; leaves ovate or ovate-elliptic, 2–5 cm. long, sparsely strigose-pilose on both surfaces; flowers double, 5 or 7, racemose.

CULTIVATED: Arnold Arboretum 516–51, *S. Y. Hu*, June 1954 (A), Nov. 1, 1954 (A).

This form was distributed by the Cole Nursery of Ohio. Nothing is known of its origin. It resembles *P.* "Virginal" but had more uniform flowers and a lower habit.

10g. *Philadelphus* "Pyramidal" Lemoine, Cat. 192: 21. 1919.

Bark grayish brown, closed, the current year's growth glabrescent; leaves broad-ovate 3–6 cm. long, 2–4 cm. wide, denticulate, rounded or subcordate at the base, shortly acuminate at the apex; flowers 7 or 5, the corolla 3 cm. across, the outer petals suborbicular, 1.2 cm. diameter.

CULTIVATED: Arnold Arboretum 19266, *E. J. Palmer*, June 22, 1938 (A), *S. Y. Hu*, June 14, 1951 (A); 1099–28, *Kobuski & Roush*, Sept. 10, 1931 (A); 22025, *E. J. Palmer*, June 11, 1936 (A).

This form was introduced into the Arnold Arboretum in 1925 from the Lemoine Nursery. That specimen bears the field number 19266.

10h. *Philadelphus* "Virginal" Lemoine, Cat. 173: VI, *t.* [6]. 1909, 188: 13. 1915. — Bean, *Trees Shrubs* ed. 7, 2: 415. 1950.

Bark gray, tardily wearing off, the current year's growth glabrous; leaves ovate, rather large, 4–8 cm. long, 3–4.8 cm. wide, obtuse at the base, serrate, with 1–4 teeth on each side; flowers 7, 9, rarely 5 or 3, the corolla various, semi-double, double, or on some branches simple, 3–4 cm. across, the outer petals obovate, 1.2–2 cm. long, rounded at the apex.

CULTIVATED: Arnold Arboretum 7596, *A. Rehder*, July 2, 1918 (A); *E. J. Palmer*, June 11, 1936 (A); 15424, *C. K. Allen*, June 21, 1927 (A).

Lemoine announced this form as a variety of the first class. Bean also considered it as the finest form in the genus and mentioned the award of the first class certificate in 1911 by the Royal Horticultural Society, London. But the plant in the Arnold Arboretum has a very irregular growth. Many branches are over-vigorous in vegetative growth and bear no flowers. Various parts of the same plant bear different flowers, some being simple while others are double. It is interesting but not very desirable for small gardens.



11. *Philadelphus* × *maximus* Rehder in Mitt. Deutsch. Dendr. Ges. 1913 (22): 255. [1914]; et Man. Cult. Trees Shrubs 276. 1927, ed. 2, 270. 1940. — Moore in Bailey, Stand. Cycl. Hort. 5: 2582. 1916.

A tall shrub up to 5 m. high, the principal branches 5 cm. in diameter, bark of the second year's growth light gray, closed, the current year's growth glabrescent. Leaves ovate or ovate-elliptic, on the vegetative shoot 8–12 cm. long, 4–6.5 cm. wide, on the flowering shoot 6–8 cm. long, 3–4 cm. wide, rounded, obtuse or rarely cordate at the base, acuminate at the apex, subentire or faintly denticulate, sparsely hirsute above, tomentose beneath. Flowers 7 or 9, the lower pairs in the axils of normal leaves; hypanthium and sepals sparsely scabrous-pilose, the hairs partly erect; sepals ovate, 5 mm. long, acute or shortly acuminate; corolla cruciform, 3–3.5 cm. across, the petals obovate, 13 mm. long; stamens 26, the anthers sterile; disc and style glabrous, the stigmata clavate.

CULTIVATED: Arnold Arboretum 6606, *A. Rehder*, June 24, 1913 (A, TYPE); 6606-1 = 15373, without collector, June 21, 1916 (A).

This plant was received from Kew in 1885 as *P. tomentosus*. It was probably a hybrid produced accidentally in that garden. Its robust stems and great height show hybrid vigor. Its completely sterile stamens indicate the disturbed chromosomes. Rehder was probably right in assuming it to be a hybrid between *P. pubescens* and *P. tomentosus*. It is a very rare specimen.

12. *Philadelphus* × *nivalis* Jacques in Hort. Univ. 2: 19. 1841. — Rehder, Man. Cult. Trees Shrubs 273. 1927, ed. 2, 267. 1940.

*Philadelphus verrucosus* var. *nivalis* (Jacques) Rehder in Jour. Arnold Arb. 1: 199. 1920.

An arching shrub up to 2.5 m. high, the bark castaneous, exfoliate, the current year's growth glabrous. Leaves ovate or ovate-elliptic, 5–10 cm. long, 2.5–6 cm. wide, rounded or obtuse at the base, acuminate at the apex, subentire or faintly denticulate, glabrescent above, uniformly strigose-villose beneath. Flowers 5 up to 11, in interrupted racemes, the lower pairs in the axils of normal leaves; hypanthium and sepals scabrous-villose, the hairs dense, long, and partly erect; sepals ovate, acuminate, 7 mm. long; corolla disciform, 2.5–3.5 cm. across, the petals suborbicular, 1.3–1.5 cm. in diameter; stamens all fertile; disc and style glabrous.

CULTIVATED: Europe: Kew, *G. Nicholson* 2596 (A). United States: Arnold Arboretum, *C. E. Faxon*, June 16, 1911 (A); 15356-1-A, *E. J. Palmer*, June 11, 1936 (A); 22026, *E. J. Palmer*, June 11, 1936 (A), *S. Y. Hu*, June 14, 1951 (A); vicinity of the Arnold Arboretum, Orchard St., *A. Rehder*, June 21, 1910 (A); Eliot St., *C. E. Faxon*, June 20, 1911 (A); Hort. C. S. Sargent, *A. Rehder*, June 22, 1910 (A).

This cultivar is assumed to be a hybrid of *P. coronarius* Linn. and *P. pubescens* Loisel. It is one of the most commonly cultivated *Philadel-*

*phus* in the gardens of Boston. Rehder in his Manual mentioned a double-flowered form, *P. × nivalis* f. *plenus* (Späth) Rehder. I have not seen any specimen of this form.

13. *Philadelphus × congestus* Rehder in Jour. Arnold Arb. 1: 200. 1920; Man. Cult. Trees Shrubs 280. 1927, ed. 2, 268. 1940; et Bibl. Cult. Trees Shrubs 192. 1949.

An arching shrub, the bark castaneous, exfoliating, the current year's growth pubescent; leaves elliptic, 3–3.5 cm. long, 1–2.5 cm. wide, acute at both ends or shortly acuminate at the apex, uniformly strigose-pilose beneath, the hairs appressed; flowers 5 in short racemes, rarely 3 or solitary, the hypanthium sparsely pilose, the corolla subdisciform, 3 cm. across, the petals obovate.

CULTIVATED: Arnold Arboretum 5854, *A. Rehder*, June 24, 1912 (A, TYPE); 349–29, *E. J. Palmer*, Aug. 18, 1936 (A), June 22, 1938 (A).

This species originated in the Späth Nursery near Berlin and was distributed as *P. inodorus speciosus grandiflorus*. The parents are probably *P. inodorus* var. *laxus* and *P. pubescens* var. *verrucosus*. Arnold Arboretum 349–29 was distributed by the Vilmorin Nursery as "*P. Yokohamae*."

14. *Philadelphus × monstrosus* (Späth) Schelle in Beissner et al., Handb. Laubh.-Ben. 129. 1903, *nom. subnud.* — Rehder in Jour. Arnold Arb. 1: 199. 1920; et Man. Cult. Trees Shrubs 273. 1927, ed. 2, 268. 1940.

*Philadelphus gordonianus monstrosus* Hort. ex. Späth. Kat. 100: 95. 1897, *nom. nud.*

A moderately tall shrub about 2 m. high; bark of the second year's growth gray, closed, the current year's growth glabrous or glabrescent. Leaves ovate, rarely ovate-elliptic, 3.5–9 cm. long, 2.5–5.5 cm. wide, partially sparsely strigose-pilose above, uniformly strigose-villose beneath. Flowers 7 or 9, racemose, the lower pairs in the axils of normal leaves; hypanthium sparsely weak-villose, the hair almost erect; corolla cruciform, 3.5–4 cm. across, the petals oblong; stamens all fertile, the disc glabrous, the style glabrous or with a few hairs at the base, the style half divided, the stigma spatulate. Capsule turbinate, the persistent calyx supermedian. Seeds long-caudate.

CULTIVATED: Arnold Arboretum 6965, *A. Rehder*, July 3, 1917 (A, TYPE); 6965–2 = 5881, *A. Rehder*, June 18, 1918 (A); 6965–3 = 15373, *A. Rehder*, July 18, 1918 (A); 6965–4 = 15374, *E. J. Palmer*, June 14, 1921 (A).

This taxon was distributed by the Späth Nursery as *P. gordonianus monstrosus*. Rehder assumed it to be a hybrid between *P. lewisii* var. *gordonianus* and *P. pubescens*. It differs from *P. pubescens* only in having a less densely pubescent hypanthium.

15. *Philadelphus* "Slavinii" Hort. ex Wyman, Shrubs Vines Am. Gard. 422. 1949. *nom. nud.*

A tall mound-shaped shrub 3 m. high with arching and drooping branches, the bark castaneous, exfoliate, the current year's growth glabrous. Leaves elliptic or ovate-elliptic, 6.5–9.5 cm. long, 2–3.5 cm. wide, acute at the base, acuminate at the apex, glabrous above, uniformly strigose-pilose beneath, subentire or with 2–5 teeth on each side. Flowers 5, crowded, rarely 3 or 1; hypanthium and sepals uniformly strigose-villose; sepals ovate, acuminate, 7 mm. long; corolla cruciform, 4–6 cm. across, the petals oblong, rounded at the apex; disc and style glabrous. Capsules ellipsoid. Seeds long-caudate.

CULTIVATED: Arnold Arboretum 1067–36, *E. J. Palmer*, June 24, 1936 (A), Oct. 18, 1938 (A), Sept. 29, 1940 (A); *S. Y. Hu*, Nov. 1, 1954 (A).

This plant resembles *P. inodorus* var. *grandiflorus* in the tall, mound-shaped habit, serrate, ovate-elliptic leaves, and large flowers. But it can be readily distinguished by its pubescent hypanthium. In the Arnold Arboretum, also, it flowers two or three weeks later than *P. inodorus* and its varieties. When in full bloom the entire plant is covered with white balls of flowers. In my opinion it is a very superior specimen. The Arnold Arboretum obtained the specimen from Mrs. W. W. Gibbs, Staunton, Virginia, in the form of cuttings in 1936. Nothing is known about its origin.

16. *Philadelphus* "Stenopetala" Carr. in Rev. Hort. 1870: 340. 1870. — Moore in Bailey, Stand. Cycl. Hort. 5: 2582. 1916.

Bark castaneous or nigrescent, closed; leaves ovate, 4–7.5 cm. long, 1.8–3 cm. wide, obtuse at the base, acuminate at the apex, faintly serrate, uniformly strigose-pilose beneath; flowers 5 or 7, racemose, the hypanthium and sepals sparsely pilose; corolla subcampanulate, 1.5 cm. across, the petals oblanceolate, 8 mm. long, 3 mm. wide, obtuse or rounded at the apex, glabrous inside.

CULTIVATED: Hort. Miss L. C. Crehore, Moss Hill, Jamaica Plain, Mass., *J. G. Jack*, June 22, 1926 (A).

The narrow petals and stellate corolla of this form suggest some relationship with *P. falconeri*. But the glabrous petals, pubescent hypanthium, and racemose inflorescence are very distinctive. In *P. falconeri* the corolla is hirtellous on the inside, the hypanthium glabrous, and the pedicels of the lower pairs of flowers are elongated and sometimes divided, giving the inflorescence the appearance of a corymb. It may be a mutant of *P. pubescens*.

17. *Philadelphus* "Maculiflorus" Koehne ex Schneider, Ill. Handb. Laubh. 1: 363. 1905, 2: 929. 1912. — Rehder, Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940.

Bark castaneous, exfoliate. current year's growth glabrous. Leaves ovate or ovate-elliptic, 5–8 cm. long, 2–5 cm. wide, rounded or obtuse at the base, barbate, and on the primary nerves pubescent, denticulate, with 5–9 teeth on each side. Flowers 7 in loose racemes, the lower pairs in the axils of normal leaves; pedicels 7–12 mm. long; hypanthium and sepals glabrous; corolla subdisciform, 3 cm. across, the petals obovate, 1.3 cm. long, reddish at the base; stamens ca. 35; all fertile; style and disc glabrous. Capsules turbinate, 7 mm. long, 6 mm. in diameter.

CULTIVATED: **Europe:** Bot. Gart. Leipzig, *A. Rehder* 3121 (A); Hort. Bot. Dresden, *C. K. Schneider*, June 25, 1904 (A, type material)

This form is apparently a bud mutant of *P. coronarius*. It is not known in American gardens and may now be non-existent in European gardens as well.

18. *Philadelphus* × *purpureo-maculatus* Lemoine, Cat. 152: VIII. 1902. — Hemsl., Bot. Mag. 134: *t.* 8193. 1908. — Wayland in Gard. 82: 267, *fig.* 1918, 84: 336, *fig.* 1920. — Rehder in Jour. Arnold Arb. 1: 203. 1920; et Man. Cult. Trees Shrubs 280. 1927, ed. 2, 274. 1940. — A. O[sborn] in Gard. 87: 396, *fig.* 1923, 89: 652, *fig.* 1925. — Jeffery in Gard. Chron. 113: 104, *fig.* 55. 1943.

*Philadelphus* × *phantasia* Moore in Bailey, Stand. Cycl. Hort. 5: 2582. 1916.  
*Philadelphus lemoinei* var. *maculatus* Gard. Chron. III. 36: 140. 1904.

Bark nigrescent, closed, slowly wearing off; current year's growth pubescent. Leaves broad-ovate, 1–3.5 cm. long, 0.6–2.5 cm. wide, rounded at the base, acute at the apex, entire or with 1 or 2 teeth on each side, very sparsely pilose beneath. Flowers solitary, the hypanthium and base of the sepals partially strigose-pilose; sepals leafy, ovate, 7 mm. long; corolla disciform, 2.5–3 cm. across, the petals ovate, 11 mm. long, 10 mm. wide, purplish red at the base. Capsules ellipsoid, 6 mm. long, 5 mm. in diameter, the persistent sepals circumferential.

CULTIVATED: **Europe:** Bot. Gart. Forstakademie 57, *H. Zabel*, June 29, 1905 (A). **United States:** Arnold Arboretum 1102–28, *Kobuski & Roush*, Sept. 30, 1931 (A); Highland Park, New York, *R. E. Horsey*, Sept. 4, 1918 (BH); Garden of A. & A. Blake, Berkeley, California, *N. F. Bracelin* 2522 (BH).

Lemoine in 1900 made a cross between *P. microphyllus* and a purple-centered *Philadelphus* which was horticulturally known as *P. coulteri*, not Watson, and produced *P. "Fantaisie"* (Lemoine Cat. 146: X. 1900). From the seed of this horticultural form he raised *P. × purpureo-maculatus*. I have not seen any specimen of *P. "Fantaisie"* and I doubt if it can be found in any American gardens. *Philadelphus* × *purpureo-maculatus* is also rare in America.

The flowers of the following forms have been reported to have purplish rose or pink centers: "Étoile rose," "Fantaisie," "Galathée," "Nuage rose," "Oeile de pourpre," "Roméo," "Sirène," "Surprise," and "Sylviane." These



forms are rare in American gardens. The information here presented is largely abstracted from the original descriptions, which were published in French and are not available in most botanical institutions in America.

*Philadelphus* "Belle étoile," *P.* "Bicolore" and *P.* "Sybille" were announced as offspring raised from seeds of *P.*  $\times$  *purpureo-maculatis*. It has been discovered that they are forms with triploid chromosomes. They are not included here among the following diploid purple-eyed forms. At present these triploid forms are also rare in American gardens. They have large flowers and a late and long blooming season. Their purple-centered flowers are very attractive. Very likely they will soon gain popularity among growers.

18a. *Philadelphus* "Etoile rose" Lemoine, Cat. 173: 24. 1909, 176: 26. 1910, 188: 12. 1915.

It was stated that this form came from a cross between *P.* "Fantaisie" and *P.*  $\times$  *purpureo-maculatus*. It has large flowers and elongated petals which are white blotched with pink.

18b. *Philadelphus* "Fantaisie" Lemoine, Cat. 176: X. 1900.

It was reported that this form was obtained through a cross between *P. coulteri* and a variety of *P. lemoinei*. It has large disciform flowers fringed at the margin, pure white, pale rose at the center.

18c. *Philadelphus* "Galathée" Lemoine, Cat. 188: 12. 1915.

A shrub with long arching branches, medium-sized leaves, single cup-shaped flowers, white, slightly tinged in the center.

18d. *Philadelphus* "Nuage rose" Lemoine, Cat. 190: 22. 1916.

A very free flowering shrub with small leaves, large fragrant flowers with slightly fringed petals, white with a broad center of soft flax-rose.

18e. *Philadelphus* "Oeile de pourpre" Lemoine, Cat. 177: 7. 1911, 188: 12. 1915.

A low shrub with small leaves, large, simple, cup-shaped flowers, the petals cream-white blotched with dark purple at the center.

18f. *Philadelphus* "Roméo" Lemoine, Cat. 185: 37. 1913, 188: 12. 1915.

A vigorously growing shrub, tufted and floriferous, with rather small scabrous leaves, medium-sized flowers with the petals cream-white, blotched wine-purple at the base.

18g. *Philadelphus* "Sirène" Lemoine, Cat. 176: 26. 1910, 188: 13. 1915.

Bark nigrescent, tardily wearing off, the current year's growth glabrous, axillary buds enclosed; leaves ovate-elliptic, 5–9.5 cm. long, 2.5–4 cm. wide, obtuse at the base, acuminate at the apex, glabrous above, sparsely

villose on the nerves beneath, remotely denticulate; flowers 3 or 5; capsules obovoid, slightly strigose-pilose.

CULTIVATED: Arnold Arboretum 1063-36, *E. J. Palmer*, Sept. 25, 1940 (A).

This form is distinguished from the other purple-centered forms by its large leaves. The Arnold Arboretum obtained its plant from W. W. Gibbs, Staunton, Va., in 1936.

18h. *Philadelphus* "Surprise" Lemoine, Cat. 182: 35. 1912, 188: 13. 1915.

A shrub with rather large and well-presented flowers, the petals white blotched with carmine-purple at the base.

18i. *Philadelphus* "Sylviane" Lemoine, Cat. 191: 21. 1917.

This form was announced as a superb cultivar with large, well-expanded flowers, the broad petals pure white suffused with pale pink at the base.

19. *Philadelphus* "Bicolore" Lemoine, Cat. 192: 21. 1919. — Janaki Ammal in Jour. Hort. Soc. London 76: 273. 1951.

A low shrub 1 m. high; bark castaneous, tardily exfoliate, the current year's growth sparsely villose, the axillary buds slightly exposed. Leaves ovate or oblong-ovate, 2.5-4 cm. long, 1-2 cm. wide, obtuse at the base, acuminate at the apex, with 1, 2, or 3 teeth at the middle of each side, slightly hirsute above, uniformly strigose-pilose beneath. Flowers solitary, rarely ternate, the hypanthium and sepals uniformly sparsely strigose-villose; sepals foliaceous, ovate-lanceolate, 11 mm. long, 4 mm. wide at the base; corolla subcampanulate, 4.5-5 cm. across, the petals ovate or suborbicular, 2.2 cm. long, 1.8 cm. wide; hirtellous on the inside; stamens ca. 29; disc and style glabrous. Capsules subglobose, 6 mm. in diameter. Seed long-caudate.

CULTIVATED: Arnold Arboretum 604-36, *E. J. Palmer*, Oct. 13, 1938 (A); June 24, 1943 (A); *S. Y. Hu*, June 22, 1951 (A); 16222, *E. J. Palmer*, June 22, 1938 (A).

The Arnold Arboretum obtained its plants from two sources, 604-36 from Kew in 1936, and 16222 from T. A. Havemeyer, Long Island, N. Y. The latter specimen was received as *P.* "Belle étoile." So far as I can detect, *P.* "Bicolore" is distinguished from *P.* "Belle étoile" by its fertile stamens and its petals being sparsely hirtellous on the inside. Arnold Arboretum 16222 is a typical *P.* "Bicolore."

This form is the most strikingly beautiful, and interesting *Philadelphus* in the Arnold Arboretum collection. From a distance the cup-shaped flowers appear white. A closer view shows that the petals are purple at the base, yellowish at the middle and white at the apical half. Exposed to open

pollination, from three to twenty percent of its seeds are fertile. Mr. Lewis Lipp, former Propagator at the Arnold Arboretum, collected the seeds in 1950. He raised ninety individuals, all from one mother plant. Being a triploid, in the formation of the gametes, the chromosomes are not evenly distributed. Thus the seeds of that plant carry different genomes, and the offspring show an enormous degree of variation in vitality, vigor, height, color, indumentum, shape, size, and dentation of the leaves, and in the size, type, and color of the flowers. Mr. Dexter R. Sampson, a graduate student of Dr. Karl Sax, has made a cytological survey of all the surviving individuals. He concluded that it is evident there is no correlation between the shape and dentation of the leaves and the chromosome number.<sup>1</sup>

When Lemoine announced this garden form, he did not give its origin. Janaki Ammal accredited it to the selfing of the diploid hybrid *P. purpureo-maculatus*. The shape of the petals and the indumentum on the leaves and hypanthium remind one of *P. floridus*, and the soft yellow hairs on the inside of the petals suggest a relationship with *P. mexicanus*.

20. *Philadelphus* "Belle étoile" Lemoine, Cat. 197: 18. 1923.—  
Janaki Ammal in Jour. Hort. Soc. London 76: 273, fig. 144. 1951.

Bark castaneous, tardily exfoliate, the current year's growth sparsely villose, the axillary buds exposed. Leaves ovate, 1.5–4 cm. long, 1–2 cm. wide, rounded or obtuse at the base, shortly acuminate at the apex, sparsely hirsute above, uniformly strigose-pilose beneath. Flowers ternate or solitary, the hypanthium and sepals uniformly and sparsely villose; sepals ovate-lanceolate, 10–11 mm. long; corolla subcampanulate, 4.5–5 cm. across, the petals ovate, 2.2 cm. long, 1.8 cm. wide, glabrous on both surfaces; stamens ca. 27, the anthers sterile; the disc and style glabrous.

CULTIVATED: Arnold Arboretum 18535, *E. J. Palmer*, June 22, 1938 (A); 21880, *E. J. Palmer*, June 10, 1936 (A).

This is a comparatively more recent production. The Arnold Arboretum obtained its plants in 1925 and 1932 respectively; number 18535 was from the Chenault Nursery, Orleans, France, and no. 21880 came from the Lemoine Nursery. These specimens resemble *P. "Bicolore"* in the size of their leaves, in the indumentum, and the size and color of their flowers. Nevertheless this form can be distinguished from *P. "Bicolore"* by its sterile anthers and glabrous petals.

## DOUBTFUL AND EXCLUDED SPECIES

Pochlaks and Zamelis in 1939 reported the creation of ten hybrids, giving botanical recognition to all of them. Some of the named parents, such as *P. falconeri*, are sterile hybrids, and others are invalid species. I am

<sup>1</sup> Dexter R. Sampson, Studies on the Progeny of the Triploid *Philadelphus* and *Forsythia*, in *Jour. Arnold Arb.* 36: 369–384. 1955.

very doubtful about the identity of those parent plants. All the ten *nomina nuda* are listed here.

1. PHILADELPHUS ABELEI (*P. lewisii* × *P. verrucosus*) Pochlaks & Zamelis in Acta Horti Bot. Univ. Latv. 11-12: 230. 1939, *nom. nud.*
2. PHILADELPHUS ARACHNOIDEUS Soland. ex Gaertn., Fruct. Sem. Pl. 1: 174. 1788, *nom. nud.* = *Leptospermum arachnoides* Gaertn. l.c. t. 35, fig. 3. 1788 = *L. arachnoideum* Seem. in Trans. Linn. Soc. 3: 263. 1797. Native of Australia.
3. PHILADELPHUS ARBORESCENS Browne, Hist. Jam. 240. 1789. = *Eugenia uniflora* Linn., Sp. Pl. 470. 1753. Native of Jamaica.
4. PHILADELPHUS AROMATICUS Ait., Hort. Kew. ed. 1, 2: 156. 1789 = *Leptospermum ericoides* A. Rich., Bot. Voy. Astrol. 1: 338. 1832. Native of New Zealand.
5. PHILADELPHUS CORYMBOSUS Wall., Num. List 3652. 1829 = *Deutzia staminea* R. Br. ex Wall., Num. List 3651. 1829; et Pl. As. Rar. 2: 82, t. 191. 1831.
6. PHILADELPHUS FLORIBUNDUS Usteri in Roemer & Usteri, Mag. Bot. 3 (7): 177, t. 2, 1790 = *Leptospermum scoparium* Forster, Char. Gen. Pl. 72, t. 36. 1776. Native of New Zealand.
7. PHILADELPHUS GALENICKII (*P. acuminatus* × *P. magdalenae*) Pochlaks & Zamelis in Acta Horti Bot. Univ. Latv. 11-12: 230. 1939, *nom. nud.*
8. PHILADELPHUS IMBRICATUS Soland. ex Gaertn., Fruct. Sem. Pl. 1: 175. 1788 = *Baeckea crenulata* D.C., Prodr. 3: 230. 1828. Native of Australia.
9. PHILADELPHUS JANSONII (*P. latifolius* × *P. verrucosus*) Pochlaks & Zamelis in Acta Horti Bot. Univ. Latv. 11-12: 231. 1939.
10. PHILADELPHUS KETELÉERII Carr. in Rev. Hort. 1866: 44. 1866. Carrière recorded that the plant which this name represented was raised from seed of *P. coronarius* cultivated in the grounds of the Museum of Natural History in Paris. It has double or semidouble flowers with pointed petals fringed or dentate at the apex. It is very doubtful whether this form is still in existence.
11. PHILADELPHUS LAEVIGATUS Soland. ex Gaertn. Fruct. Sem. Pl. 1: 175. 1788 = *Fabricia laevigata* Gaertn., l.c. = *Leptospermum laevigatum* F. Muell., Ann. Rep. 22. 1858; et Fragm. Phytogr. Austr. 4: 60. 1864. Native of Australia.
12. PHILADELPHUS LANIGER Ait., Hort. Kew. ed. 1, 2: 156. 1789 = *Leptospermum pubescens* Lam., Encyc. 3: 466. 1791. A native of Australia.
13. PHILADELPHUS LATVICUS (*P. latifolius* × *P. microphyllus*) Pochlaks & Zamelis in Acta Horti Bot. Univ. Latv. 11-12: 230, pl. 2. 1939. — Rehder, Man. Cult. Trees Shrubs ed. 2, 273. 1940; et Bibl. Cult. Trees Shrubs 194. 1949. — *Nom. nud.*
14. PHILADELPHUS LODDIGESIANUS Koehne in Gartenfl. 45: 562. 1896. — Schneider, Ill. Handb. Laubh. 1: 371. 1905. According to Koehne's description this species has dark brown bark, ovate-lanceolate, acuminate, dentate leaves, and one, three, or five flowers with glabrous or sparsely pubescent hypanthia. Schneider remarked that this binomial represented a hybrid of unknown origin, and he doubted that it was still in cultivation in 1905.



15. PHILADELPHUS MALTAE (*P. purpurascens*  $\times$  *P. coronarius aureus*) Pochlaks & Zamelis in Acta Horti Bot. Univ. Latv. 11-12: 230. 1939, *nom. nud.*
16. PHILADELPHUS MELDERI (*P. magdalenae*  $\times$  *P. schrenkii*) Pochlaks & Zamelis, l.c. *nom. nud.*
17. PHILADELPHUS MYRTIFOLIUS Soland. ex Gaertn., Fruct. Sem. Pl. 1: 175. 1788 = *Fabricia myrtifolia* Gaertn., l.c., t. 35, fig. 4 = *Leptospermum fabricia* Benth., Fl. Austral. 3: 102. 1867. A native of Australia.
18. PHILADELPHUS SCOPARIUS Ait., Hort. Kew. ed. 1, 2: 156. 1789 = *Leptospermum scoparium* Forst., Char. Gen. Pl. 72, t. 36. 1776. A native of New Zealand.
19. PHILADELPHUS SKUJAE (*P. acuminatus*  $\times$  *P. schrenkii*) Pochlaks & Zamelis in Acta Horti Bot. Univ. Latv. 11-12: 231. 1939, *nom. nud.*
20. PHILADELPHUS SQUARROSUM Soland. ex Gaertn., Fruct. Sem. Pl. 1: 174. 1788 = *Leptospermum squarrosus* Gaertn., l.c. t. 35, fig. 3 = *L. scoparium* Forst., l.c.
21. PHILADELPHUS STAMINEUS Wall., Pl. As. Rar. 2: 82. 1831 = *Deutzia staminea* R. Br. ex Wall. Num. List 3651. 1829; et Pl. As. Rar. 2: 82, t. 191. 1831.
22. PHILADELPHUS TAUJAE (*P. lewisii*  $\times$  *P. latifolius*) Pochlaks & Zamelis in Acta Horti Bot. Univ. Latv. 11-12: 230. 1939, *nom. nud.*
23. PHILADELPHUS TREBOUXII (*P. falconeri*  $\times$  *P. latifolius*) Pochlaks & Zamelis, l.c., *nom. nud.*
24. PHILADELPHUS VEGII (*P. falconeri*  $\times$  *P. lewisii*) Pochlaks & Zamelis, l.c., *nom. nud.*
25. PHILADELPHUS "Cole Glorious" Wyman, Shrubs Vines 226. 1949 = *P. intactus* Beadle in Biltm. Bot. Stud. 1: 160. 1902.
26. PHILADELPHUS LEWISII var. PARVIFOLIUS S. Y. Hu in Jour. Arnold Arb. 36: 77. 1955, non Torrey = *Philadelphus lewisii* var. *pygmaeus*, *nom. nov.*
27. PHILADELPHUS LEWISII var. PLATYPHYLLUS (Rydb.), S. Y. Hu, op. cit. 78. = *P. lewisii* var. *platyphyllus* (Rydb.) A. H. Moore in Rhodora 16: 77. 1914.
28. PHILADELPHUS SERICANTHUS var. ROCKII Koehne — S. Y. Hu, op. cit. 343, should read *P. sericanthus* var. *bockii*.

ARNOLD ARBORETUM,  
HARVARD UNIVERSITY.

## EXPLANATION OF PLATES V AND VI

### PLATE V

REPRESENTATIVES OF THE POECILOSTIGMA SECTION, THE HABIT SKETCHES  $\times \frac{1}{2}$ , AND THE STIGMAS, STYLES AND DISCS  $\times 2\frac{1}{2}$ . 1. *P. affinis* (Pringle 8833) with fruit  $\times \frac{1}{2}$  (Moore 3238). 2. *P. myrtoides* (Calderon 687) with pubescent style and cristate stigmas (Standley 82517). 3. *P. austromexicanus* (Ghiesbreght 813). 4. *P. mexicanus* (Siede) with fruit  $\times 1$ . 5. *P. pueblanus* (Nicolas 171). 6. *P. glabripetalus* (Pringle 6311).

### PLATE VI

REPRESENTATIVES OF THE SECTIONS COULTERIANUS AND STENOSTIGMA, THE HABIT SKETCHES  $\times \frac{1}{2}$ , AND THE STIGMAS, STYLES AND DISCS  $\times 2\frac{1}{2}$ . 1. *P. coulteri* with pubescent style and disc (Coulter 77). 2. *P. oblongifolius* with elongated pubescent style (Purpus 5368B), the hairs with glandular thickened bases ( $\times 20$ ). 3. *P. osmanthus* with very short style (Chase 7310), the fruit  $\times 1$ . 4. *P. pringlei* (Pringle 10174). 5. *P. sargentianus* (Sargent in 1887, fruit from Pringle 2094). 6. *P. calcicola* with united cristate stigmas and glabrous style. (Meyer & Rogers 2662). 7. *P. coronarius* with the longitudinal section of a fruit ( $\times 2\frac{1}{2}$ , Sargent, July 9, 1903). 7a. Seed of *P. caucasicus*. 8. *P. pekinensis* (Hers 2515). 9. *P. tomentosus* with split stigmatic surfaces (Osmanton 382).



HU, THE GENUS PHILADELPHUS



HU. THE GENUS PHILADELPHUS



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